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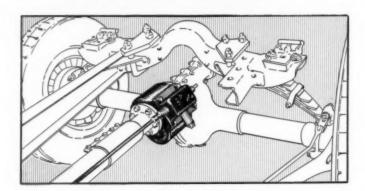
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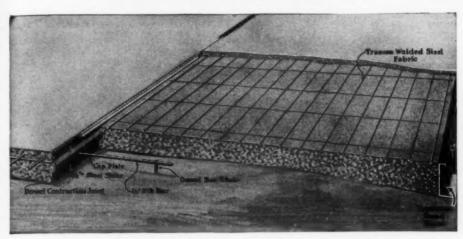
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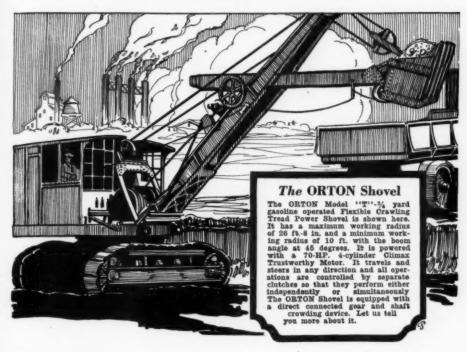
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\*Ciyde Ir. Wks. Sales Co., Duluth, Minn.
\*Dobble Fdry. & Mach. Co., Miagare Falls
\*Orton Crane & Shovel Co., Chicago.
Amer. Hst. & Derrick Co., St. Paul.
Austin Machy Corp., Muskegen, Mich.
Hayward Co., N. Y.
Nat'l. Hstg. Eng. Co., Harrison, N. J.
Street Bros. Mach. Wks., Chattanooga.

DERRICK FITTINGS

\*S. Flory Mfg. Co., Bangor, Pa.
Lidgerwood Mfg. Co., N. Y.
Street Bros. Mach. Wks., Chattanooga

DIAPHRAGM PUMPING OUTFITS
\*John Lausen Mig. Co., New Hell
Wis.

DIESEL ENGINES (See Engines, 0il) DISTRIBUTORS, TAR AND ASPHALT Kinney Mfg. Co., Boston.

DISTRIBUTING PLANTS, CONCRETE
\*Lakewood Eng. Co., Cleveland.
\*Inaley Mfg. Co., Indianapolis, Ind.
\*Ransome Conc. Mchy. Co., Dunellen,N.J.
Archer Iron Works, Chicago.

DITCHING MACHINES (See Excavators)

DIVIDING PLATES (BOAD) \*W. S. Godwin Co., Baltimore.

DOORS AND SHUTTERS, STEEL ROL-OORS AND SHUTTLES, STATES LING
Cornell Iron Wks., B'klyn., N. Y.
Kinnear Mfg. Co., Columbus, O
Variety Fire Door Co., Chicago
J. G. Wilson Corp., N. Y.

DRAFTING MACHINES Univ. Drafting Mach. Co., Cleveland, O.

PREDGES
\*Bay City Dredge Wks., Bay City, Mich.
\*Erie Steam Shovel Co., Erie, Pa.
\*Orton Crane & Shovel Co., Chicage.
\*Street Bros. Mach. Wks. Chattaneoga.
Amer. Steel Dredge Co., Ft. Wayne, Ind
Bucyrus Co., So. Milwaukee, Wis.
Ellicott Machy. Corp., Baltimore
Hayward Co., N. Y.
Lidgerwood Mfg. Co., N. Y.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Stockton Iron Wks., Stockton, Cal.
Superior Iron Wks., Superior, Wis.

DREDGES, DIPPER
\*Bay City Dredge Wks., Bay City, Mich.
\*Link-Bat Co., Ohicago.
Amer. Steel Dredge Co., Ft. Wayne, Ind.
Austin Machy. Corp., Muskegon. Mich.
Bucyrus Co., So. Milwankee, Wis.
Marion. Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC Bucyrus Co., South Milwaukee, Wis. Ellicott Mach. Corp., Baltimore. Marion Steam Shovel Co., Marion, O. Morris Mach. Wks., Baldwinsville, N.Y.

DREDGING MACHINERY \*S. Flory Mfg. Co., Bangor, Pa. Lidgerwood Mfg. Co., N. Y. Street Bros. Mach. Wks., Chattanooga

DREDGING PUMPS AND ACCESSORIES Eric Pump & Engine Wks., Medina, N.Y. Ingersoll-Rand Co., N. Y.

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\*McKiernan-Terry Drill Co., N. Y.
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\*Dallett Co., Philadalphia.

\*Danver Rock Drill Mfg. Co., Denver.

\*Bardsog Wonder Drill Co., E. Y.

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Chicago Pneum. Tool Co., N. Y.

Cleveland Pneum. Tool Co., Cleveland, O.

Glinan Mfg. Co., E. Boston.

Helwig Mfg. Co., St. Paul, Minn.

Independent Pneum. Tool Co., Chicage.

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Ingersoll-Rand Co., N. Y. W. H. Keller, Inc., Grand Haven, Mish. Wood Drill Wks., Paterson, N. J.

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HOLES (See Well Drilling Machy)
DRUMS, HOLDING
"Blaw-Knox Co., Pittsburgh, Pa.
"Clyde Ir. Whs. Sales Co., Dulth, Minn.
"Dobble Pdry. & Mch. Co., Risgara Palls.
Hayward Co., N. Y.
Monighan Machine Co., Chicago.
Street Bros. Mach. Wks., Chattanooga.
DRYERS, ASPHALT AND CEMENT
Allis-Chalmers Mfg. Co., Milwaukee.
Amer. Blower Co., Detroit, Mich.
Amer. Process Co., N. Y.
Alla Dryer Co., Cleveland, O.
C. O. Bartlett & Snow Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
Mosher Mfg. Co., Chicago.
Ruggles-Coles Eng. Co., N. Y.
DRYERS, SAND AND GRAVEL

Allas Dry.
C. O. Bartiett & Son Vo.
F. D. Cummer & Son Vo.
Moshor Mfg. Co., Chicago.
Ruggles-Coles Eng. Co., N. Y.

DRYERS, SAND AND GRAVEL
\*Aeroil Burner Co., Elkhart, Ind.
\*Jos. Honhorst Co., Cincinnast, O.
\*Littleford Bros., Cincinnast, O.
\*Alex. Milburn Co., Baltimore, Md.
C. O. Bartiett & Snow Co., Cleveland, O.
Chase & Lyman, Boston
Mosher Mfg. Co., Chicago.

\*Body Co., Chicago.

\*Body Co., Chicago.

\*MOTOR TRUCKS

\*MOTOR TRUCKS

\*\*Allar Mills Chalmers Mfg. Co., Milwaukee.
Cushman Motor Wis., Lincoln, Neb.
Fa.

\*\*Body Co., Chicago.

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Cushman Motor Wis., Lincoln, Neb.
Fa.

\*\*Cimax Eng. Co., Chicago.
Cushman Motor Wis., Lincoln, Neb.
Falls Chalmers Mfg. Co., Milwaukee.
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Filt Chalmers Mfg. Co., Milwaukee.
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Cushman Motor Wis.

\*\*Allar Chalmers Mfg. Co., Milwaukee.
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Cushman Motor Wis.
\*\*Allar Chalmers Mfg. Co., Milwaukee.
\*\*Constant Chalmers Mfg. Co., Milwaukee.
\*\*Constant Chalmers Mfg. Co., Milwaukee.
\*\*Constant Chalmers M

Mosher Mig. Co., Chicago.

DUMP BODIES FOR CONCRETE

\*Easton Car & Const'n., Co., Easton, Pa.
Lee Trailer & Body Co., Chicago.

DUMP BODIES FOR MOTOR TRUCKS

\*Anthony Ce., Streator, Ill.

\*Easton Car & Const'n., Co., Easton, Pa.

\*Hell Co., Milwauke.

\*Highway Trailer Co., Edgerton, Wis.

\*Insley Mig. Co., Indianapolis, Ind.

\*Littleford Bros., Cincinnatt, O.

\*Mack Trucks, Inc., N. Y.

\*Marion Steel Body Co., Marion, O.

\*Wood Hydr. Hoist & Body Co., Detroit.

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Am. Truck & Body Co., Martinsville, Va.

Archer Iron Wks., Chicago.

Atia Corp., New York.

Columbia Body Corp., Columbia, Pa.

Amer. Proc. a. S. C. Martinsville, v. A. Am. Truck & Body Co., Martinsville, v. Archer Iron Wks., Chicago.
Atia Corp., New York.
Columbia Body Corp., Columbia, Pa.
Columbian St. Tank Co., Kansas City, Mo.
Detroit Trailer & Mach. Co., Detroit.
Detwiler Mfg. Co., Galion, O.
Eagle Wagon Wks., Auburn. N. Y.
Galion All Steel Body Co., Galion, O.
Griscom-Russell Co., N. Y.
Herr Damp Car Mfg. Co., Coatesville, Pa.
Hughes-Keenan Co., Mansfield, O.
The Hug Co., Highland, Ill.
Jennings Aut. Dump Body, Roanoke, Vs.
Lee Trailer & Body Co., Chicago.
Mandt Body Co., Keokuk, Is.
Martin-Parry Corp., York, Ps.
V. Cantral Ir. Wks., Hagerstown, Md. Mandt Body Co., Reokus, Is.
Martin-Parry Corp., York, Pa.
N. Y. Central Ir. Wiks., Hagerstown, Md.
Pechatein Iron Wiks., Keokuk, Ia.
Stewart Iron Wiks. Co., Cincinnati.
Superior Body Corp'on., Marion, Ind.
Van Dorn Iron Wiks., Cleveland.

yan Lorn Lron Wks., Cleveland.
DUMP CARTS AND WAGONS, HORSE
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\*Austin-Western Rd. Machy. Co., Chicage
\*Eagle Wagon Wks., Auburn, N. Y.
\*Highway Trailer Co., Edgerton, Wis.
\*La Plant-Choate Mig. Co., Cedar Rapids,
\*In.\*\*
\*Russell Grader Mig. Co.

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\*Russell Grader Mfg. Co., Usdar haplus,

\*Russell Grader Mfg. Co., Emigaville, Pa.

Acme Wagon Co., Emigaville, Pa.

Austin Mfg. Co., Chicago.

Bain Wagon Co., Kenosha, Wis.

Columbia Body Corp., Columbia, Pa.

Gilbert Mfg. Co., Aberdeen, S. D.

Hagy Wagon Co., Aberdeen, S. D.

Hagy Wagon Co., Abingdon, Va.

G. H. Holsbog & Bro., Jeffersonville, Ind.,

Little Red Wagon Co., Omaha, Neb.

Rez-Wateon Corp., Canastota, N. T.

Stockland Rd. Machy, Co., Minneapolls,

Streich Bros., Oshkosh, Wis.

Thornhill Wagon Co., Lynchburg, Va.

Western Wheeled Scraper Co., Aurora,

Ill.

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Crocker-Wheeler Co., Ampere, N. J.
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General Elec. Co., Schenectady, N. Y.
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Fairbanks, Morse & Co., ConFairbanks, Morse & Co., ConGeneral Elec. Co., Schenectady, N. Y.
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Ideal Elec. & Mfg. Co., Manafield, O.
Lincoin Elec. & Mfg. Co., Manafield, O.
Kobbins & Myers Co., Springfield, O.
Triumph Elec. Co., Clincinnati, O.
Wagner Elec. Mfg. Co., St. Louis.
Westinghouse Elec. & Mfg. Co., E.

General Elec. Co., Schenectady, N. Y. Westinghouse Lamp Co., N. Y.

Allis-Chalmers Mfg. Co., Milwaukee. General Elec. Co., Schenectady, N. Y. Kuhlman Elec. Co., Bay City, Mich. Westinghouse Electric & Mfg. Co., Westinghouse Elect E. Pittsburgh, Pa.

ELECTRIC WIRES (See Wire)

ELECTRIC WIRES (See Wire)

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\*Atlas Eng. Co., Milwaukee.

\*Austin-Western Rd. Machy. Co., Chicago.

\*Chain Belt Co., Milwaukee, Wis.

\*Good Rds. Machy. Co., Kennett Sq., Pa.

\*Geo. Haiss Mfg. Co., N. Y.

\*Link-Belt Co., Chicago.

\*Littleford Bros., Cincinnati.

\*Russell Grader Mfg. Co., Minneapolis.

\*Spears-Wells Machy. Co., Oakland, Cal.

Austin Mfg. Co., Chicago.

C. O. Bartlett & Snow Co., Cleveland, O.

Fairfield Eng. Co., Marlon, Ohio.

Glifford-Wood Co., Hudson, N. Y.

Jeffrey Mfg. Co., Columbus, O.

Robins Conv. Belt. Co., N. Y.

Univ. Rd. Machy. Co., Kingston, N. Y.

Webster Mfg. Co., Chicago.

Weller Mfg. Co., Chicago.

Worthington Pump & Mchy. Corp., N.Y.

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Warsaw Elev. Co., Warsaw, ...

ENGINES. GAS AND GASOLINE

\*Alamo Eng. Co., Hillsdale, Mich.

\*Claterpillar Tr'tor Ce., San Leandro, Cal.

\*Climax Eng. Co., Clinton, Is.

\*Continental Motors Corp., Muskegon,

Mich.

Tolaware. O.

Lidgerwood Mfg. Co., N. 1.

EXCAVATING MACHINERY (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY

\*Amer. Mfg. & Eng. Co., Kalamagoo, Mich.

\*Link-Belt Co., Chicago.

\*Domestic Eng. & Pump Co., Shippensburg, Pa.

\*Hercules Metors Corp., Canton, O.

\*John Lanson Mfg. Co., New Holstein, Wis.

\*Le Rei Co., Milwankee.

\*Novo Engine Co., Lansing, Mich.

\*Stover Mfg. & Eng. Co., Freeport, III.

\*Stover Mfg. & Eng. Co., Freeport, III.

\*Stover Mfg. Co., Milwankee.

Bauda Co., Harvey, III.

C. H. & E. Mfg. Co., Wilwankee.

Charter Gas Eng. Co., Sterling, III.

Chicago Pneum. Tool Co., N. Y.

Cushman Motor Was, Lincoln, Neb,

Evirrude Motor Co., Milwankee.

Fairbanks, Morse & Co., Chicago,

Foos Gas Eng. Co., Springfield, O.

Fuller & Johnson Mfg. Co., Madisen,

Wis.

Hinkley Motors, Inc., Detoit \*Domestic Eng. & Pump Co., Shippens

Wis.
Hinkley Motors, Inc., Detroit,
Ingersoil-Rand Co., New York,
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
Sanderson-Cyclone Drill Co., Orrville, O.
Sterling Eng. Co., Buffalo, N. Y.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wisconsin Motor Mfg. Co., Milwaukee,
Worthington Pump & Mchy. Corp., N.Y.

ENGINES, HOISTING (See Hoists)

engines, Kerosene \*Alamo Eng. Co., Hillsdale, Mich. \*John Lauson Mfg. Co., New Holstein, Wis. Eng. Co., Clinton, Ia.

\*Climax Eng. Co., Clinton, Ia.

\*Stover Mfg. & Eng. Co., Freeport, III

\*Waukesha Motor Co., Waukesha, Wis.

ENGINES, OIL DIESEL Allis-Chalmers Mfg. Co., Milwaukee. Busch-Sulzer Bros.-Deisel Eng. Co., St.

Louis.
Fulton Iron Wks. Co., St. Louis.
McIntosh & Seymonr Corp., Anburn.N.Y.
Nordberg Mfg. Co., Milwaukee.
St. Mary's Oil Eng. Co., St. Charles.Mo.
Western Machy. Co., Los Angeles, Cal.

SEMI-DIESEL
\*Stover Míg. & Eng. Co., Freeport, Ill.
Anderson Fdry. & Mach. Co., Anderson, Ind.

Bessemer Gas Eng. Co., Grove City, Pa.
Bessemer Gas Eng. Co., Sterling, III.
Chicago Fneum. Tool Co., N. Y.
De La Vergne Mach. Co., N. Y.
De La Vergne Mach. Co., N. Y.
Lombard Gov. Co., Ashland, Mass.
Muncie Oil Eng. Co., Springfield, O.
Ingersoil-Rand Co., N. Y.
Lombard Gov. Co., Ashland, Mass.
Muncie Oil Eng. Co., Muncie, Ind.
New London Ship & Eng. Co., Groton, Cl.
Nordberg Mfg. Co., Milwaukee.
Taylor Mach. Co., Cleveland, O.
Worthington Pump & Mchy. Corp., N.Y.
NGINESS DITMYPING Ind.

ENGINES, PUMPING GRINES, PUMPING

\*Climax Eng. Co., Clinton, Ia.

\*Stover Mfg. & Eng. Ce., Preepert, Il.

\*Stover Mfg. & Eng. Ce., Preepert, Il.

\*Waukesha Motor Co., Waukesha, Wis.

Allis-Chalmers Mfg. Co., Milwaukee.

Hooven, Owens, Rentschler Co., Hamilton, O.,

Murray Iron Wks., Burlington, Ia.

Nordberg Mfg. Co., Milwaukee.

Worthington Fump & Mehy. Corp., N.Y.

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Lidgerwood Mfg. Co., N. Y.

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Swedish Crucible Steel Co., Detroit. EXCAVATORS, DITCH AND TRENCH

Street Bros. Mach. Whs., Chattanoga.

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\*Barber-Greene Ce., Aurora, III.

\*Bay City Dredge Whs., Bay City, Mich.

\*Buckeye Trac. Ditcher Ce., Findlay, O.

\*Byers Mach. Ce., Ravenna, O.

\*Clyde Ir. Whs. Sales Ce., Duluth, Minn.

\*Eric Steam Shovel Co., Eric, Pa.

\*Harnischfeger Corp., Milwankee.

\*Innley Mig. Co., Indianapolis, Ind.

\*Keystene Driller Co., Beaver Palls, Pa.

\*Link-Belt Co., Chicago

\*Moore Speedcrane Co., Chicago.

\*Orton Crane & Shovel Co., Chicago.

\*Parsons Ce., Newton, Ia.

\*Russell Grader Mig. Co., Minneapolis

\*Speeder Machy. Corp., Cedar Rapida, Ia.

American Hist. & Derrick Co., St. Paul.

Austin Mach. Corpa., Munkegon, Mich.

Brown Histg., Machy. Co., Cleveland.

Bucyrus Co., So. Milwankee, Wis.

\*Cleveland Trencher Co., Euclid, O.

Economy Exc. Co., Iowa Falls, Ia.

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Harward Co., N. Y.

Marion Steam Shovel Co., Marion, O.

Monighan Mach. Co., Chicago.

Osgood Co., Marion, O.

Owensboro, Ey.

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\*Thew Shovel Co., Dayton, O.

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\*Bay City Dredge Whs., Bay City, Mich.

C. T. Topping Machy. Co., Dayton, O.
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"Galion Ir. Wrs. & Mig. Co., Minn.
"Grie Steam Shovel Co., Eric, Fa.

"Galion Ir. Wrs. & Mig. Co., Minn.
"Grie Steam Shovel Co., Chicago.
"Orton Crane & Shovel Co., Chicago.
"T. L. Smith Co., Milwaukee, Wis.
"Speedar Machy. Corp., Muskegon, Mich.
Brown Histg. Machy. Corp., Muskegon, Mich.
Brown Histg. Machy. Co., Cleveland, O.
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Becale & Sons, Pittsburgh, Pa.
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Youngstown Pressed St. Co., Warren, Expansion Joint Material.

\*Earber Asphak Co., Philadelphia.

\*Earrett Co., E. Y.

\*Philip Carey Co., Cincinnati, O.

\*W. E. Meadows, Inc., Eighs, Ill.

\*Truscon Steel Co., Youngstown, O.

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Pioneer Asph. Co., Lawrenceville, Ill.

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\*\*PENCING\*\*

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Adrian Wire Fence Co., Adrian, Mich.
Amer. Fence & Const. Co., New York.
Anchor Post Iron Works, N. Y.,
Cyclone Fence Co., Waukegan, Ill.
Dwiggins Wire Fence Co., Waren, O.
Ill. Wire & Mfg. Co., Joliet, Ill.
Ind. Steel & Wire Co., Morton, Ill.
Koystone Stl. & Wire Co., Morton, Ill.
Koystone Stl. & Wire Co., Kokomo, Ind.
Nitselman Bros., Muncie, Ind.
Mich. Wire Fence Co., Adrian, Mich.
Page Stl. & Wire Prod. Corp., Bridgeport, Conn.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Ir. Wis. Co., Cincinnati, O.
Tex. Cyclone Fence Co., F. Worth, Pax.
Van Dorn Iron Wks. Co., Cleveland, O.
Wickwire-Spencer Steel Co., N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

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Ahrens-Fox Fire Eng. Co., Cincinnati, O.
American-La France Fire Eng. Co.,
Elmira, N. Y.

Boyer Fire App. Co., Logansport, Ind.
Brockway Motor Fire App. Co., Cortlandt, N. Y.
Foamite-Childs Corp., Utica, N. Y.
Hale Fire Pump Co., Conshohocken, Pa.
Northern Fire Apparatus Co., Minneapolis, Minn.

Hale Fire Fump Co., Constantace, r. Northern Fire Apparatus Co., Minneapolis, Minn.
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Prospect Fire Engine Co., Prospect, O.
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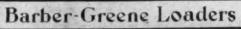
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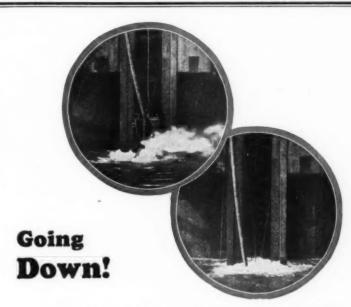
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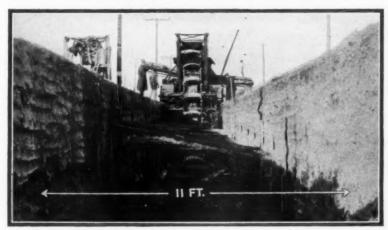
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Allis-Chalmers Mfg. Co., Mineapolis.

Austin Mfg. Co., Cleveland, O.

Co. Brown Hsig. Machy. Co., Cleveland, O.

J. I. Case Threshing Mach Co., Racine,

Wis.

J. I. Case Threshing mach Co., Racine, Wis.
Deister Concentrator Co., Ft. Wayne, Ind. Gifford-Wood Co., Hudson, N. Y.
Hendrick Mfg. Co., Carbondale, Pa-Jeffrey Mfg. Co., Columbus, O.
Lyle Culv. & Rd. Equip. Co., Minneapo-

lis, Minn.
Morrow Mfg. Co., Wellston, O.
Newaygo Eng. Co., Newaygo, Mich.
New Jersey Wire Cloth Co., Trenton,
N. J.
Robins Conv. Belt Co., N. Y.
H. B. Sackett Screen & Chute Co.,

H. H. Sackett Screen & Chate Co., Chicago. Universal Rd. Mach. Co., Kingston, N.Y. Webster Mfg. Co., Chicago. Weller Mfg. Co., Chicago. Wickwire Spencer Steel Co., N. Y.

SCREENS, SEWAGE

PREENS, SEWAGE
'Link-Beit Co., Philadelphia.
Dorr Co., New York.
Green Bay Fdry. & Mach. Wks., Green
Bay, Wis.
Sanitation Corp'n., N. Y.
Simplex Ejector Co., Chicago.

SEWAGE DISPOSAL APPARATUS \*Vink-Belt Co., Chicago.

\*Pacific Flush Tank Co., Chicago & N. Y.
Dorr Co., N. Y.
Sanitation Corp'n., N. Y.
Simplex Ejector Co., Chicago. SEWAGE PUMPS (See Pumps)

SEWAGE EJECTORS WAGE EJECTURS
Pacific Flush Tank Co., Chicago & N. Y.
Sanitation Corp., N. Y.
Simplex Ejector Co., Chicago.
Yeomans Bros. Co., Chicago.

SEWER BLOCKS, SEGMENT
American Vit. Products Co., Akron, O.
Cannelton Sewer Pipe Co., Cannelton, Ind.

Ind.
Denver Sewer Pipe & Clay Co., Denver,
Col.
W. S. Dickey Clay Mfg. Co., Kansas
City, Mo.
Evens & Howard Fire Brick Co., St.
Louis, Mo.
Laclede Christy Clay Prod. Co., St.
Louis, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
Pacific Clay Prod. Co., L. Angeles, Cal.
Red Wing Sewer Pipe Co., Red Wing,
Minn.

Minn. Robinson Clay Prod. Co., Akron, O. Standard Fire Brick & Sewer Pipe Co., Pueblo, Col.

SEWER CLEANING APPARATUS PWER CLEANING APPARATUS
Atis Corp., New York.
F. Bissell Co., Toledo, O.
Champion Corp., Hammond, Ind.
Self Propelling Nozsle Co., N. Y.
Turbino Sewer Mach. Co., Milwaukee.

SEWER PIPE AND DRAIN TILE American Vit. Prod. Co., Akron, O. Blackmer & Post Pipe Co., St. Louis, Wm. E. Dee Co., Chicago. Denver Sewer Pipe & Clay Co., Denver, Co. Dehver Sewer Pape & Cay Co., Leaner, Cal.
W. S. Dickey Clay Mfg. Co., K. City, Mo. Logan Clay Prod. Co., Logan, O. Ohio Vit. Pipe Co., Uhrichaville, O. Robinson Clay Prod. Co., Akron, O.

M. & M. Wire Clamp Co., Minneapou Dayton Sure Grip & Shore Co., Day ton, O. The O. D. G. Co., Owensboro, Ky. H. W. Roos Co., Cincinnati, O. Roos-Meyer-Hecht Co., Cincinnati, O. Symons Clamp & Mfg. Co., Chicago. Universal Form Clamp Co., Chicago.

\*M. & M. Wire Clamp Co., Minneapolis Dayton Sure Grip & Shore Co., Day-

SEWEE PIPE FORMS

\*Heitzel Stl. Form & Ir. Co., Warren, O. Quinn Wire & Iron Wks., Boone, Ia. Raber & Lang Mfg. Co., Kendallville, Ind.

SEWER PIPE JOINT COMPOUNDS

Pacific Flush Tank Co., Chicago & N. Y.
G. K. Sales Agency, Macangle, Pa.
Ruberoid Co., N. Y.
Servicised Prod. Corp., Chicago

WEE RODS
F. Biasell Co., Toledo, O.
Champion Corp., Hammond, Ind.
P. J. Healy, Jersey City, N. J.
Luck Sewer Equip. Co., Chicago,
Turbine Sewer Mach. Co., Milwa

SHINGLES, METAL
Aluminum Co. of Am., Pittsburgh, Pa.
Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
Klauer Mfg. Co., Dubuque, Is.
Milwaukee Corrugating Co., Milwaukee,
Nat'l Sheet Metal Roofing Co., Jersey
City, N. J.
Newport Rolling Mill Co., Newport, Ky.
Penn Metal Co., Boston.

Wheeling.

Penn Metal Co., Boston.
Tiffin Art Metal Co., Tiffin, O.
Wheeling Metal Mfg, Co., V
W. Va.

SEWER RODS

SHORES

SHOVELS, ELECTRIO

\*Bay City Dredge Wks., Bay City, Mich.
\*Byers Mach. Co., Eavenna, O.
\*Keehring Co., Milwaukee, Wis.
\*Link-Belt Co., Chicago.
\*Speeder Machy. Corp., Cedar Rapids, Ia.
Bucyrus Co., So. Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Oagood Co., Marion, O.
Thew Shovel Co., Lorain O.

Thew Shovel Co., Lorain O.

SHOVELS, GASOLINE

\*Bay City Dredge Wha., Bay City, Mich.
\*Byers Mach. Co., Eavenna, O.
\*Eries Steam Shovel Co., Erie, Pa.
\*General Excavator Co., Marion, O.
\*Harnischfeger Corp., Milwaukes, Wis.
\*Koshring Co., Milwaukes, Wis.
\*Link-Beit Co., Chicago.
\*Orton Crane & Shovel Co., Oticago.
\*Speeder Machy. Corp., Cedar Rapids, Ia.
\*Universal Fower Shovel Co., Detroit.
Amer. Steel Dredge Co., Ft. Wayne, Ind.
Austin Mach. Corp., Muskeyon, Mich.
Brown Hatg. Machy. Co., Cleveland, O.
Bucyrus Co., So. Milwaukeo, Wis.
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Osgood Co., Marion, O.
Thew Shovel Co., Lorain O.

SHOVELS. GASOLINE (FORDSON) \*Insley Mfg. Co., Indianapolis, Ind. \*Universal Power Shovel Co., Detroit. Universal Power Shoval Ce., Detreit.
Anthony Co., Streator, III.
Hughes-Keenan Co., Cleveland.
Mandt Company, Keokuk, Ia.
Milwaukes Elec. Crane & Mfg. Co., Milwaukee Squier-Rix Co., Milwaukee.

SHOVELS, HAND American Mfg. Co., Chattanooga, Tena. Ames Shovel & Tool Co., Boston. Baldwin Tool Wks., Parkorsburg, W. Va. Beall Bros. Co., Alton, 111.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.\*

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Gen'l Sales Offices: Peoples Gas Bldg., Chicago, Ill.

Conneaut Shovel Co., Conneaut, O. Hubbard & Co., Pittsburgh, Pa. Indiana Shovel Co., New Castle, Ind. Jackson Shovel Co., Montpelier, Ind. Pittsburgh Shovel Co., Pittsburgh, Pa. Stevens-Webb Co., Inc., Altoona, Pa. Union Furnace Mfg. Co., Altoona, Pa. Wood Shoval & Tool Co., Piqua, O. Wyoming Shovel Wks., Wyoming, Pa. HOVELS, STEAM

Wyoming Shovel Wiss, Wyoming, Pa. SHOVELS, STEAM
\*Erie Steam Shovel Ce., Erie, Pa.
\*Ksystone Driller Co., Beaver Falls, Pa.
\*Orton Crane & Shovel Ce., Chicago.
Austin Mach. Corp., Muskegon, Mich.
Bellwood Stm. Shovel Co., Bellwood, Pa.
Bucyrus Co., So. Milwaukee, Wis.
Industrial Wks., Bay City, Mich.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Russell & Co., Massillon, O.
Thew Shovel Co., Lorain O.

SIDEWALK AND ROAD FORMS (See Forms, Concrete)

SIGNS, STREET AND ROAD GNS, STREET AND ROAD Alumoyd Sign & Signal Co., Chicago. Auto Sign Display Co. of Mo., St. Louis, Mo. Baltimore Enam. & Nov. Co., Baltimore. Elkhart Fdry. & Mach. Co., Elkhart, Ind.

Ind.
Evernu-Century Sign Co., Boston.
Ingram-Richardson Mfg. Co., Beaver
Falls, Fa.
Lyle-Signs, Minneapolis, Minn.
Municipal Street Sign Co., N. Y.
Rochester St. Signal Co., Rochester, N.Y.
Standard Mfg. Co., Cedar Falls, Ia.
Union Iron Prod. Co., E. Chicago, Ind.
Western Stamping & Mfg. Co., St. Paul

SIGNS, TRAFFIC

Acme Traffic Signal Co., Los Angeles.
Alumoyd Sign & Signal Co., Chicago.
Auto Sign Display Co. of Mo., St.
Louis, Mo.

Alumoya Auto Sign Display Louis, Mo. Automatic Signal & Sign Co., Canton, O. Amer. Gas Accumulator Co., Elizabeth,

Automatic Signal & Sign Co., Canton, O. Amer. Gas Accumulator Co., Elizabeth, N. J.
Crouse-Hinds Co., Syracuse, N. Y.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Easco Mfg. Co., Peoria, Ill.
Evernu-Century Sign Co., Boston.
Griswold Safety Signal Co., Monseapolis
Horni Signal Mfg. Corp., Newark, N. J.
Line Material Co., So. Milwaukee, Wis.
Little Giant Co., Mankato, Minn.
Lyle-Signs, Minneapolis, Minn.
Ohio Traffic Devices Co., Columbus, O.
Rochester St. Signal Co., Rochester, N.Y.
Tokhelm Oil Tank & Fump Co., Ft.
Wayne, Ind. Wayne, Ind. Wayne, Ind. Union Iron Prod. Co., E. Chicago, Ind. Universal Traffic Control Co., Oklahoma City, Okla. Welsbach Traffic Signal Co., Phila.

SLEEVES, TAPPING AND VALVE Mueller Company, Decatur, Ill. Rensselaer Valve Co., Troy, N. Y. A. P. Smith Mfg. Co., East Orange, N.J.

SLUICE GATES (See Gates, Sluice) SMOKE STACKS (See Stacks, Steel)

SMUHLE STAURS (See Stacks, Steel)
SHOW CLEANING MACHINERY
\*Austin-Western Rd. Michy. Co., Chicago.
\*Basker Mfg. Co., Springfield, Ill.
\*Barber-Greene Co., Aurora, Ill.
\*Byers Mach. Co., Ravenns, O.
\*Caterpillar Tractor Co., San Leandro,
Calif. and Peoris, Ill.
\*Cleveland Tractor Co., Cleveland, O.
\*Galion Iron Wis. & Mfg. Co., Galion, O.
\*Good Rds. Mach. Co., Kennett Sq., Po.
\*La Plant-Choate Mfg. Co., Cedar Hapids,
La.

Ia.

\*Mack Trucks, Inc., N. T.

\*Mack Morrison Mig. Co., E. Boston.

\*Russell Grader Mig. Co., Minneapolis.

C. D. Edwards Mfg. Co., Albert Lea, G. D. Edwards Mig. Co., Albert Lea, Minn. Hiway Service Corp., Wausau, Wis. Killefer Mfg. Co., Los Angeles, Cal. Linn Mfg. Co., Morris, N. Y. Monarch Tractors Corp., Springfield, Ill. Owensboro Ditcher & Grader Co.,

Owensboro, Ky.

Owensboro, Ky.

Rotary Snow Plow Co., Minneapolis.

Shaw-Enochs Tractor Co., Minneapolis.

W. M. Toy Co., Sidney, O.

Union-Iron Wks., Inc., Bangor, Me.

Walshs Holyoke St. Bir. Wks., Holyoke, Mass.

Walter Snow Fighters, L. I. City, N. Y. SNOW FENCING \*Good Machy. Co. Kennett

Good Roads Machy. Co. Kem Square, Pa. Cyclone Fence Co., Waukegan, Ill. Wickwire-Spencer Steel Co., N. Y. SPADES (See Shovels)

SPRAYERS, ASPHALT AND TAR \*Littleford Bros., Cincinnati. Kinney Mfg. Co., Boston.

SPRAYING MACHINERY FOR TREES
Bean Spray Pump Co., Lansing, Mich,
Field Force Pump Co., Elmira, N. Y.
Fitzhenry-Guptill Co., E. Cambridge,

SPREADERS, STONE

\*Austin-Western Ed. Mchy. Co., Chicage.

\*Galion Ir. Wiss. & Mfg. Co., Galion, O.

Burch Plow Wiss. Co., Crestline, O.

Shaw-Enochs Tractor Co., Minneapolis.

Shaw-Enochs Tractor Co., Minneapons.
STACKS, STEEL

\*Blaw-Knox Co., Pittsburgh, Pa.

\*Connery & Co., Inc., Philadelphia.

\*Hoil Co., Milwaukee, Wis.

\*Jos. Honhorst Co., Cincinnati, O.

\*M. Y. Central Iron Wks. Co., Inc.,

Hagerstown, Md.

Birmingham Tank Co., Birmingham, Ala.

Chatta, Boiler & Tank Co., Chatta., Tenn.

Chicago Bridge & Iron Wks., Chicago.

Graver Corp., Chicago.

Fetroleum Iron Wks. Co., Sharon, Pa.

Pittsburgh-Des Moines Steel Co., Pitts
burgh, Pa.

burgh, Pa.

W. B. Scaife & Sons, Pittsburgh, Pa.

Walsh & Weidner Boiler Co., Chattanooga, Tenn.

nooga, Tenn.

STANDPIPES, TANKS AND TOWERS
W. E. Caldwell Co., Louisville, Ky.,
Chatta. Bir. & Tank Co., Chatta., Tenn.,
Chicago Bridge & Ir. Wks., Chicago.,
Lancaster Iron Wks., Lancaster, Pa.,
Pacific Tank & Pipe Co., San Francisco.
Petroleum Ir. Wks. Co., Sharon, Pa.,
Pittsburgh-Des Moines Steel Co., Pitts
burgh, Pa.,
United Iron Wks., Inc., K. City, Mo.,
Waish & Weldner Boiler Co., Chatta
nooga, Tenn.

alsh & Weid

STEAM SHOVELS (See Shovels, Steam) STEAM TURBINES (See Turbines)

STEAM TURBINES (See Turbines)

STEEL PLATE CONSTRUCTION

\*Blaw Knox Co., Pittsburgh, Pa.

\*Connery & Co., Philadelphis.

\*Heil Co., Milwaukee, Wis.

\*Heiltel St. Form & Ir. Co., Warren, O.

\*Jos. Honborst Co., Cincinnati, O.

\*Littleford Bros., Cincinnati, O.

\*Littleford Bros., Cincinnati, O.

\*Union Iron Wks., Inc., Hoboken, N. J.

Bethlehem Steel Co., Bethlehem, Pa.

Biggs Boiler Wks., Akron, O.

Birmingham Tank Co., Birmingham Ala.

Chatta, Boiler & Tank Co., Chatta, Tenn.

Chicago Bridge & Iron Wks., Chicago.

Graver Corp., E., Chicago, Ind.

Hendrick Mfg. Co., Carbondale, Pa.

McClintic Marshall Co., Pittsburgh, Pa.

N. Y. Central Iron Wks. Co., Inc.,

Hagerstown, Md.

Penna. Bridge Co., Beaver Falls, Ia.

Petroleum Iron Wks. Co., Sharon, Pa.

Pittsburgh-Des Moines Steel Co., Pittsburg, Pa.
Riter-Conley Co., Pittaburgh, Pa.
W. B. Scaife & Sons, Pittaburgh, Pa.
Toledo Crane Co., Toledo, O.,
Walsh & Weidner Blr. Co., Chatta., Tenn.

\*Wemlinger, Inc., N. Y.

STOKERS, MECHANICAL
Automatic Furnace Co., Dayton, O.
Babcock & Wilcox Co., N. Y.
Combustion Engineering Corp., N. Y.
Detroit Stoker Co., Detroit.
Sanford Riley Stoker Co., Worcester, Mass. Westinghouse Ele Pittsburgh, Pa. Elec. & Mfg. Co., E.

STREET AND ROAD SIGNS (See Signs) STREET CLEANERS' CARTS
Durlach Can & Iron Wks., B'klyn, N.Y.
Rochester Can Co., Rochester, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N.Y.

Tarrant Mig. Co., Saratoga Springs, N.Y.

STREET FLUSHERS AND SPRINKLERS

\*Austin-Western Ed. Michy. Co., Chicage.

\*Galion Ir. Wiss. & Mig. Co., Galion, O.

\*Heil Co., Milwaukee, Wis.

\*Kinney Mig. Co., Boston.

\*Mack Trucks, Inc., N. Y.

\*White Co., Cleveland, O.

Autocar Co., Ardmore, Pa.

E. D. Etnyre & Co., Oregon, Ill.

Federal Motor Truck Co., Detroit.

Chas. Hvass & Co., N. Y.

Municipal Supply Co., So. Bend, Ind.

White Co., Cleveland, O.,

Yellow Truck & Coach Mig. Co., Chicago

STREET LAMP POSTS TREET LAMP POSTS
\*\*Novo Engine Co., Lanning, Mich.
American Conc. Prod. Co., Chicago.
Chicago Conc. Post Co., Chicago.
J. B. Clow & Sons, Chicago.
J. B. Clow & Sons, Chicago.
Electric Ry. Equip. Co., Cincinnati, O.
King Mfg. Co., Chicago.
Union Metal Mfg. Co., Canton, O.
Westinghouse Elec. & Mfg. Co., E.
Pittahursh Pa. Westinghouse El Pittsburgh, Pa.

STREET SIGNS (See Signs, Street) \*Austin-Western Rd. Mchy. Co., Chicage.

\*Austin-Western Rd. Mchy. Co., Chicage.

\*Good Rds. Mach. Co., Kennett Sq., Fa.

\*Kinney Mfg. Co., Boston.

Butler Mfg. Co., Cleveland, O.

Elgin Sales Corp., N. Y.

Foamite-Childs Corp., Uties, N. Y.

Foamite-Childs Corp., Utica, N. S.
STREET SWEEPING BROOMS
\*Littleford Bros., Cincinnati, O.
J. I. Holcomb Mfg. Co., Indianapolis.
Ind. Breath & Broom Mfg. Co., Indianapolis.
Ind. Hendsville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Jos. Lay Co., Ridgeville, Ind.
Milwaukee Brush Mfg. Co., Milwaukee.
Osborn Mfg. Co., Cleveland, O.
STEFET SWEEPING BROOMS

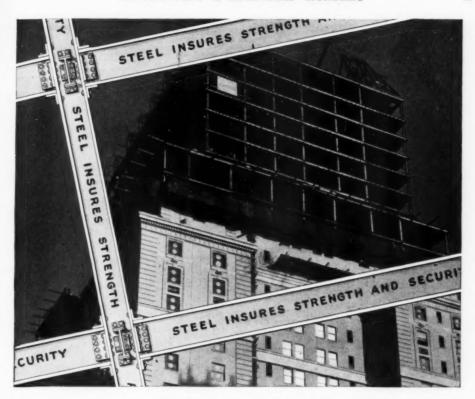
SWEEPING BROOMS

REPULLED Kendallville Brod dallville, Ind. Broom & Brush Co., Ken-Leng Broom Co., Pittsburgh, Osborn Mfg. Co., Cleveland,

STUMP PULLERS
\*Clyde Ir. Wks. Sales Co., Duluth, Minn.
\*La Plant-Choate Mfg. Co., Cedar Rapids,

La Fiant-unuación de La Co., Portland, Ore. H. L. Bennett & Co., Westerville, O. Thomas Elevator Co., Chicago.
John Waldron Corp., New Brunswick,

SUBGRADING MACHINES \*Lakewood Eng. Co., Cleveland, O. The Hug Co., Highland, Ill. Shaw-Enochs Tractor Co., Minneapolis.



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SURVEYORS' INSTRUMENTS (See Instruments)

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Westinghouse Elec. & Mfg. Co., E.
Pittaburgh, Pa.

Pittaburgh, Pa.

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Ingersoli-Rand Co., N. Y.

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\*Curtis Passum Mchy. Co., St. Louis, Mo.

\*Hoil Co., Milwankee, Wis.

\*Littleford Bros., Cincinnatt, O.

Abendroth & Root Mig. Co., N. T.

Biggs Boiler Wis., Akron, O.

Birmingham Tank Co., Birmingham, Ala.

Chicago Bridge & Iron Wis., Chicago.

Chicago Passum, Tool Co., N. Y.

Graver Corp., E. Chicago, Ind.

Independent Passum. Tool Co., Chicago.

Indiana Air Pamp Co., Indianapolis.

Ingersoli-Rand Co., N. Y.

Lancaster Iron Wis., Lancaster, Pa.

National Tube Co., Pittsburgh, Pa.

Petroleum Iron Wis., Co., Sharon, Pa.

Pittsburgh-Des Moines Steel Co., Pitts
burgh, Pa. burgh, Pa.

W. B. Scaife & Sons, Pittsburgh, Ps.

Westinghouse Tract. Brake Co., Wilmerding, Pa.

Worthington Pump & Mchy. Corp., N.Y.

Worthington Pump & Mary Conp., MAR.

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Connery & Co., Philadelphia.

Hell Co., Milwankee, Wis.

Jes. Honborst Co., Cincinnati, O.

Littleford Bros., Cincinnati, O.

Biggs Boiler Wis., Akron, O.

Birmingham Tank Co., Birmingham, Ala.

B. F. Bowser & Co., Inc., Ft. Wayne, Ind.

J. I. Case Threshing Mach. Co., Racine,

Wis.

W. E. Caldwell Co., Louiaville, Ky.

Chatta. Boiler & Tank Co., Chattanoogs, Tenn.

Chatta. Boiler & Tank Co., Chattanooga. Tenn.
Chicago Bridge & Iron Wikz., Chicago.
Columbian St. Tank Co., K. City, Mo.
Dover Boiler Whx., N. Y.
Parrell Mfg. Co., Joliet, III.
C. C. Fonts Co., Middletown, O.
Graver Corp., E. Chicago, Ind.
C. Hardesty Mfg. Co., Denver, Col.
Hendrick Mfg. Co., Carbondale, Pa.
Lancaster Iron Wks. Lancaster, Fa.
M. Y. Central Irn. Wks. Co., Hagerstown, Md.
Pacific Tank & Pipe Co., San Francisco,
Petroleum Iron Wks. Co., Sharon, Fa.
Pittaburgh-Des Moines Steel Co., Pittsburgh, Pa.

Pittaburgh Des musars burgh, Pa. Riter-Conley Co., Pittaburgh, Pa. W. B. Beaife & Sons, Pittaburgh United Iron Wiss., Inc., K. City, Mo. Walsh & Weidner Boiler Co., Chattaifted Irve.
alsh & Weidner Bone.
noogs. Tenn.
ayne Tank & Pump Co., Ft. Wayne. Wayne

TANKS, WOOD

W. E. Caldwell Co., Louisville, Ky.
G. M. Davis & Son. Palatks, Fls.
Eagle Tank Co., Chicago.
Hauser-Stander Tank Co., Cincinnati, O.,
Kalamazoo Tank & Silo Co., Kalama-Raiamanoo Tank & Silo Co., Raiamano, Mich. Pipe Co., San Francisco. Nat'l. Tank & Pipe Co., San Francisco. Redwood Mfrs. Co., San Francisco. A. T. Stearns Lumber Co., Boaton. U. S. Wind Eng. & Pump Co., Batavia, Wendnagel & Co., Chicago.

TANK WAGONS

\*Acms Bd. Mach. Co., Frankfort, N. Y.

\*Galion Ir. Wks. & Mig. Co., Galion, O.

\*Heil Co., Milwankee, Wis.

\*Jos. Honhorst Co., Cincinnati, O.

\*Mack Trucks, Inc., N. Y.

Butler Mig. Co., Minneapolis, Minn.

J. I. Case Threshing Mach. Co., Racine.

\*Barrett Co., N. Y. Amer. Tar Prod. Co., Pittsburgh, Pa.

TAR KETTLES (See Kettles)

THAWING OUTFITS

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\*Littleford Bros., Cincinnati.

Hauck Mfg. Co., Bklyn., N. Y.

TIE TAMPERS Electric Tamper & Equip. Co., Chicago.

TIE BOLTS FOR WALL FORMS
\*Hawley Tie Bolt Co., Minneapolis.

TIES, STEEL LES, STEELS Carnegie Steel Co., Pittsburgh, Pa. Int'l. Steel Tie Co., Cleveland, O. Koppel Ind. Car & Equip. Co., Koppel, Pa. Sweet's Steel Co., Williamsport, Pa.

TIMBER CLAMPS Pyle-Rogers Corp., N. Y.

TIRES, RUBBER (For Motor Trucks)
Firestone Tire & Rubber Co., Akron, O
Fisk Tire Co., Chicopee Falls, Mass.
Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Kelly Springfield Tire Co., N. Y.
U. S. Tire Co., N. Y.

TOOL HOUSES, PORTABLE STEEL
\*Blaw-Knex Co., Pittsburgh, Pa.
\*Littleford Bros., Cincinnati, O.

TORCHES, OIL (HEATING)

\*Chausse Oil Burner Co., Elkhart, Ind.

\*Littleford Bros., Cincinnati.

\*Mead-Morrison Mfg. Co., E. Boston.

\*Alex. Milburn Co., Baltimore, Md.

Hauck Mfg. Co., Bklyn., N. Y.

TOWERS (See Standpipe, Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE
\*Easton Car & Constn. Co., Easton, Pa.
\*Lakewood Eng. Co., Cleveland, C.
Atlas Car & M'g. Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Fdry, & M'g. Co., Columbus, O.
C. W. Hunt Co., Inc., W.N. Brighton, N. Y.
Koppel Ind. Car & Equip. Co., Koppel, Pa.
Bweet's Steel Co., Williamsport, Pa.

TRACTION TREADS
"Trackson Co., Milwaukee.
Belle City Mfg. Cc Racine, Wis.
Tractor Grip Wheel Co., Toledo, O.

TRACTORS FRACTORS

\*Bates Mfg. Co., Jollet, fil.

\*Caterpillar Tractor Co., San Leandro,
Cleveland Tractor Co., Cleveland, O.

\*Geo. Haiss Mfg. Co., New York.

\*Huber Mfg. Co., Marion O.

\*J. T. Tractor Co., Cleveland, O.

\*John Lausen Co., New Holstein, Wis.

\*Mack Trucks, Inc., N. Y.

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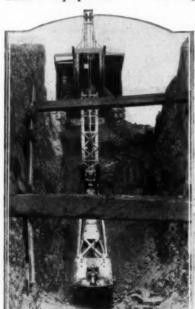
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Perfectly balanced — full-revolving — Star digs 18 feet down in hard formation without tipping tendency.

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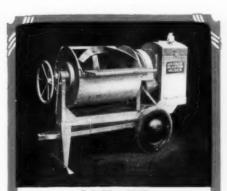
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#### **Cuts Mixing Costs in Half**

Brick mortar, patent hardwall or lime plaster (with any amount of fibre) sand or cement finish, magnesite or stucco.





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### 222



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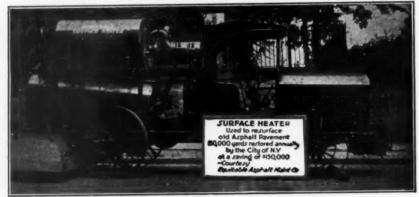
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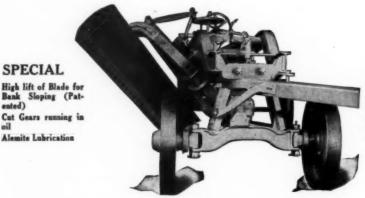
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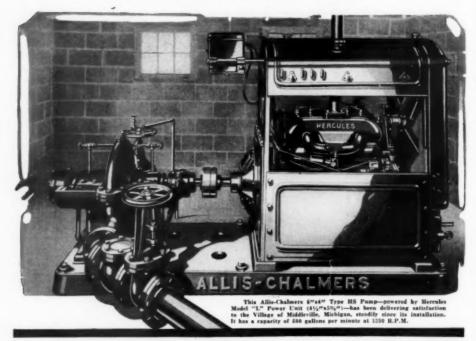
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The brown of a prize-fighter, like that of a shovel, counts for little or nothing if his foot-work is secondrate or his feet and legs are weak.





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Vol. XIV No. 3

# Contractors' Engineers' Monthly

March, 1927

#### General Features of Construction of the Cleveland Southerly Sewage Treatment Works

By ALFRED A. BURGER

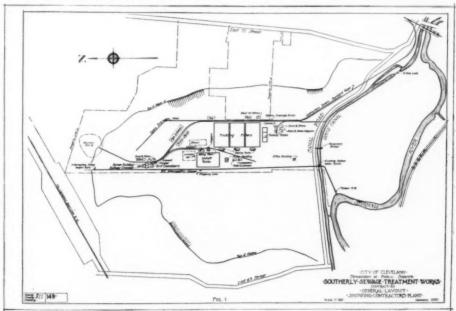
Construction Engineer with George B. Gascoigne, Consulting Sanitary Engineer, Cleveland, Ohio

THE construction of Cleveland's third sewage treatment works is now under way in the Cuyahoga River valley, opposite the Willow Station of the Baltimore and Ohio Railroad, which is about 6½ miles almost due south from the center of the city. While weather conditions during the past fall have seriously interfered with construction, the work has progressed to such an extent as to establish certain features of construction. Since sewage treatment works are continually increasing in number, these features will prob-

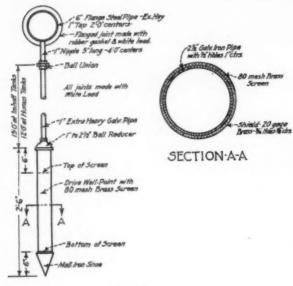
ably be of interest to many contractors, engineers and others engaged in similar work. This article has therefore been confined wholly to a consideration of the construction side of the treatment plant problem.

Brief Description of Work

The site for this plant, consisting of about 260 acres, was purchased in 1913, and since it was then intended to build a plant immediately, the excavation for the trickling filters was commenced without delay. The site is



GENERAL LAYOUT OF SOUTHERLY SEWAGE TREATMENT WORKS, CLEVELAND, OHIO



SCHEME OF WELLPOINT DRAINAGE SYSTEM
INSTALLED IN TRENCH
COMPLETELY SUREOUNDING IMHOFF TANK
EXCAVATION

Fig. 2

well isolated by natural barriers, the nearest residences being approximately one-half mile from the nearest point of any structure in the

Since the plant is located on low ground adjacent to the Ohio Canal and the Cuyahoga River, the question of drainage is an important one. Furthermore, the topography of the site is such that all surface water from a wide expanse of surrounding territory naturally collects at the location for the various structures. The normal water level in the Cuyahoga River opposite the site is Elevation 3, City Datum, and in the Canal it is Elevation 17. At the site, the average ground elevation is 20 and on three sides it rises to approximately Elevation 125, while Canal Road, which is to the south, is at Elevation 30. The bottoms of the Imhoff tanks, the deepest excavation, are at an elevation of minus 6, while those of the humus tanks are at Elevation o.

The Southerly Sewage Treatment Works are designed to care for the sewage from the southerly portion of Cleveland and vicinity, comprising approximately 70 per cent of the estimated 1940 population of the territory served, or 280,000 persons. The remainder of the city's sewage is being partially treated at the Easterly and Westerly Works, which have been in operation since 1922 and are located on the lake-front. The Southerly plant is of the Imhoff tank-trickling filter type and

present work under contract comprises grit chambers and screen building, a venturi vault and building, Imhoff tanks with control buildings, pump station and buildings, dosing tanks and trickling filters, humus tanks with continuous sludge removal mechanism, an office and laboratory building, miscellaneous conduits and pipe lines as well as the outfall section of the Southerly intercepting sewer, which consists of about 3,600 lineal feet of monolithic concrete sewer, 81/2 feet in diameter. Glasscovered sludge drying beds will form a part of the completed work, but as yet their construction has not been placed under contract. The final effluent will be discharged into the Cuyahoga River.

The following quantities give a general idea of the amount and character of the work to be done:

Excavation 200,	000 cu. yds.
Concrete 42,0	000 cu. yds.
	000 tons
	000 tons
	000 cu. ft.
	500 lin. ft.

Bids upon the work were received on October 28, 1925, and the contract for the sewage treatment works in the amount of \$2,659,-211.30 was awarded to the Mellon-Stuart Company, Pittsburgh, under date of December 23, 1925. Actual construction work was started in June, 1926. James L. Markey is Superin-

tendent for this company and J. W. Holman is Chief Engineer.

The contract for the outfall section of the Southerly Intercepting Sewer in the amount of \$220,695.00 was awarded to the Graham-Henderson Company, Cleveland, and preliminary work has progressed upon this structure approximately in accordance with the schedule for the main work.

Layout of Contractor's Plant

Generally the kind and amount of equipment used upon construction work of this character is largely dependent upon four factors, namely: (1) the financial resources of the contractor; (2) the amount and kind of equipment that the contractor has on hand; (3) working space and time of completion; (4) past experiences of contractor and his organization.

In the case of the Southerly Sewage Treatment Works, which is more or less confined in an easterly and westerly direction and quite extended in a northerly and southerly direction, an unusual requirement as regards construction plant had to be met, and especially if satisfactory progress was to be made.

In order to insure the required progress it was decided to establish three major points of operation, as follows: (1) humus tanks and

vicinity; (2) Imhoff tanks; (3) grit chambers.

Excavating equipment and concreting plants with storage bins and other appurtenances were established at each of these operation centers, and the size, type and permanency of the equipment was varied to suit the requirements of the work at a particular center. The layout of the contractor's plant is shown in Figure I.

Methods of Construction

Humus Tanks.-At the humus tanks the excavation work was done with a 2-yard Bucyrus skid-mounted dragline with a 75-foot boom. The excavated material was spoiled in the immediate vicinity of the tanks. This was possible, as the original ground surface was several feet below the finished grade. Concrete aggregates were delivered on the standard-gage switch and unloaded onto stock piles by means of a locomotive crane equipped with a clamshell bucket. The aggregates were placed as needed, from the stock piles into the batcher loading bins by the locomotive crane and bucket. A narrow-gage portable track extending from the aggregate bins and cement-storage house to the mixer was used in the delivery of materials from the bins to the mixer. Materials were placed in the proper proportion into batch boxes having a capacity of 28 cubic



PIG. 3.—WELL-POINT SYSTEM AS INSTALLED ABOUT IMHOFF TANK EXCAVATION



FIG. 4.—PILES WITH BRACKETS FOR SUPPORT AND ANCHORAGE OF HUMUS TANK BOTTOM

feet. Batch boxes were truck mounted. The batch trucks, each carrying two batch boxes, were made up into trains of 6 to 8 trucks to a train and were shifted about by small gasdriven locomotives. Usually two trains were in use at the same time, one being loaded while the other was being unloaded.

The Koehring steam-driven paver-type mixer was equipped with a derrick attachment for handling the batch boxes and had a capacity of 2/3-yard per batch. The mixed concrete was delivered by buggies to the forms. By following the foregoing procedure it was possible to pour 120 yards of concrete in 7 hours. The mixer was shifted about in order to shorten the distance that mixed concrete would have to be buggied. No provision was made for concreting in freezing weather as the concrete was practically all placed before cold weather set in.

Imhoff Tanks.—The Imhoff tanks excavation was done by means of a 1-yard Osgood gas-driven shovel and a 2-yard Bucyrus skidmounted dragline with a 55-foot boom. For the most part these machines were worked together in different lifts. The excavated material was loaded directly into trucks and disposed of in the area to be occupied by the trickling filters, which had been excavated in 1913. The filter area is immediately adjacent to the Imhoff tanks. With this equipment it was

possible to remove approximately 1,200 yards in ten hours.

Concrete aggregates were delivered on a standard-gage track and, when possible, were unloaded from a trestle by a locomotive crane equipped with a clamshell bucket. At other times, when aggregate could not be delivered on the original cars, it was loaded onto a small service car from the various storage piles and dumped from the trestle to the conveyor hoppers. The aggregates were lifted from the conveyor hoppers to the mixing bins by two 1-foot Weller bucket-conveyors, one handling stone and the other sand. From the bins the aggregates were discharged by gravity directly into an inundator or batchers as the case might be.

For the purpose of measuring the aggregates two No. 400 Blaw Knox batchers and one No. 28 Blaw Knox inundator were used. These were installed at an elevation immediately above two I-yard drum mixers, which were operated in tandem. Cement was delivered to the mixers in bags from the cement-storage house by means of a belt-conveyor. From the mixers the concrete was discharged into a bucket and hoisted to the top of a 165-foot tower, where it was delivered through counterbalanced chutes either directly into the forms or to a secondary hopper and buggied to the forms. The proportioning, mixing and

placing of concrete was at all times under rigid control. All the equipment at this point of operation was electrically driven. Under ordinary conditions it was possible to pour 300 yards of concrete in ten hours.

During cold weather and when there was danger of frost the aggregates and water were heated by steam furnished by a 150-h.p. Farquar firebox boiler which delivered live steam through perforated pipe coils placed in the bottoms and along the sides of the bins. Newly placed concrete was protected by tarpaulins and salamanders. No concreting work was done when the temperature was below 25° F., and even at temperatures somewhat higher than this the length of chuting was minimized.

Grit Chambers.—The excavation work at the grit chambers and vicinity was done with a 3/4-yard crawler-mounted Erie steam shovel. The excavation on this part of the work being very light, it was possible to store the excavated materials adjacent to the work and use it for backfilling and grading about the structures. The concreting plant layout and equipment and methods used at the grit chambers was practically a duplicate of those used at the humus tanks.

#### Well-Point System Used in Excavation

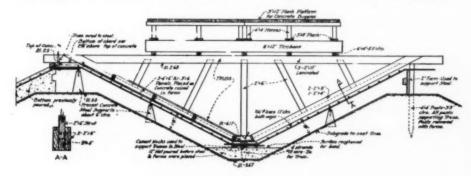
For the purpose of removing ground water in the excavation work, at the humus tanks and Imhoff tanks, individual well-point systems were used.

At the Imhoff tank area, which occupies a space of about 300 by 400 feet, the original ground surface was at approximately Elevation 21. Material encountered in the top 10 feet of excavation was composed mostly of clay with occasional pockets of fine blue sand which, when dry, was very stable, but when wet was quaky and unsafe for a shovel, even when supported on timber mats. The remain-

ing excavation at the Imhoff tanks was composed of fine sand and some gravel. When making the first cut with the shovel, it was found essential to provide drainage facilities on account of the uncertain foundation which the material afforded. A dragline was then brought in and a trench completely surrounding the Imhoff tanks excavated to approximately Elevation 9. Into this trench at Elevation 9.5 was laid a header pipe for the point system, which was placed so as to allow plenty of clearance between it and the proposed structure. Certain features of the system are shown in Figures 2 and 3.

The header pipe consisted of 6-inch extraheavy steel pipe tapped on the under side 2 feet on centers for 1-inch pipe. Into the alternate taps were screwed 1-inch extra-heavy pipe nipples 5-inches long. The other taps were plugged. Gate valves were installed in the header line at intervals of about 150 feet. These made it possible to cut out a section of the system while the remainder was kept in operation.

Well-points made by the Youngstown Sheet and Tube Company, with a length of 1-inch extra-heavy galvanized pipe attached, were jetted into place beneath each nipple and connected to the nipple by a ball union. Flexible joints were not found necessary and thus a possible source of leakage was avoided. A generous application of white lead in oil was placed on all joints before assembly to insure air-tightness of the system when completed. letting was done by using the city water pressure, which registers about 100 pounds at the site. Jetting apparatus consisted of a portable A-frame to which pulleys were attached. Ropes for raising and lowering the jetting pipe and point were passed over the pulleys and operated by hand. The jetting line consisted of a 20-foot piece of 2-inch pipe with 1-inch noz-



Pig. 5 DETAILS OF PORMS FOR IMHOFF TANK BOTTOMS

zles. This was connected to the water-main by a 2-inch flexible hose approximately 50 feet long. A valve was placed in the jetting line for the purpose of controlling the water when

the jet was not in use.

To the header line at the Imhoff tanks were connected two Wye type horizontal plunger pumps each direct-connected to a 25-hp. Fairbanks-Morse diesel engine. These were set up in small buildings at approximately Elevation 12. Water from the pumps was discharged into the open drainage ditch shown in Figure 1 at Elevation 20. The rated capacity of each pump is 1,200 gallons per minute when operating against a total head of 15 feet. The estimated average pumpage delivered by each pump on this work is 600 gallons per minute.

The humus tank excavation which was approximately 100 by 250 feet in area was made from an original ground surface at Elevation 9. The material excavated consisted of sand overlaid with about 2 feet of clay. A header line with well-points was installed in the manner described above at Elevation 11 along the north and east sides of the tank location. One pump and engine, of the same size and type as used at the Imhoff tanks, was connected to this header. The water pumped from this system was discharged into the open ditch along

the east side of the site.

It was observed that when the point systems were in use the ground water assumed a slope of about one to ten from the points. The slope assumed by the ground water would obviously vary with the kind and fineness of the soil and the length of time that the points were in operation. Also, the slope would undoubtedly be greater after a rain than after a continued dry period. With the point system in operation it was possible to maintain the sides of excavations on steeper slopes than if sump pumping or other means for removal of ground water had been resorted to. Also, the bottoms of excavations presented a uniform dryness at all times. The effect from rains was not noticeable except for the relatively small amount of water that fell directly into the excavated areas and this disappeared quite rapidly. The pumpage would usually increase slightly for some twelve to fourteen hours after a rain. Obviously it is essential, in placing well-points, that all points on a particular header system be at or below an elevation at which the system is expected to be effective.

Special Features of Construction

Humus tank bottoms.—Present construction includes three humus tanks 75 feet square in plan and 9½ feet deep on the sides. The bot-

toms are cone-shaped with a slope of I inch per foot towards the center, making the central depth of the tanks a trifle over 12½ feet. The tanks being located in low ground which eventually will be saturated with water at all times made it necessary to provide against possible floating when one or more of the units were emptied. The matter of using drainage to overcome the possible floating action had its uncertainties, consequently the more positive methods of placing additional concrete in the structures or of anchoring the structures by piling were considered. Of these two methods it was decided ot use that of anchoring the structures to piles.

Hardwood piles with 12-inch butt and 6-inch tip, 25 to 30 feet long and spaced approximately 6½ feet centers, were placed beneath the area occupied by the humus tanks. The piles were driven by means of a steam-hammer and leads were hung from the 75-foot boom on the Bucyrus dragline operating on the south side of the tanks. Steam for driving was also furnished by this unit. The piles were unloaded adjacent to the tanks from cars by a locomotive crane and were then dragged to the driver by a gas-driven locomotive on narrow-gage track. With this equipment it was possible to drive from 25 to 30 piles in eight hours.

To insure positive anchorage of the tanks to the piles, structural steel brackets were bolted to the tops of the piles. These brackets were made up of standard-angle shapes and consisted of two legs which fitted on opposite sides of the pile and extended into the concrete bottoms with cross-bars bolted to the tops of these legs. A portion of the legs and bolted connection were beneath the plane of the bottoms of the tanks, Figure 4 shows the piles and brackets.

In order to protect these legs and bolted connections below the tank bottoms, a cylinder or collar of concrete was provided for each pile. A unique method of forming was adopted for these collars. For the collar forms 18-gage sheet metal cylinders 2 feet in diameter and 2 feet long were used, the splice joint on which was made by riveting. With these metal forms which were left in place, it was possible to finish the subgrading for the tank bottoms prior to pouring the concrete collars. In this way the placing of the concrete in the tank bottoms was expedited and the collars were cast monolithically with the bottom slab.

Forms in Imhoff tank bottoms.—The Imhoff tank layout consists of 6 units, each about 110 feet long by 125 feet wide. An operating gallery divides the tanks so that there are three units on each side. Each tank unit has

four trough bottoms approximately 30 feet by 105 feet in plan and 7 feet deep. The side slopes on the trough bottoms are about 2 to 1 and these were considered too steep for finishing without the use of forms.

The trough subgrades were excavated to a true grade by the aid of templates in the shape of an inverted truss. The truss was made up of 2-inch timber. After the grading was completed a 12-inch layer of concrete was poured in the bottom of the trough. Into this concrete was placed the tie wire for anchoring the concrete form truss in place. The upper surface of this concrete was left in a roughened

Platforms for concrete buggies were laid above and supported by the trusses and the concrete was placed in the forms by the use of small portable chutes. The usual procedure followed was to place one panel at a time, the panel higher on the slope being placed after the lower one was completely filled with concrete. This procedure permitted ready access to the concrete being poured and permitted of its being spaded properly. In placing the concrete care was taken to keep the work at about the same elevation and to pour progressively along each side of the trough. It required approximately 225 yards of concrete for each

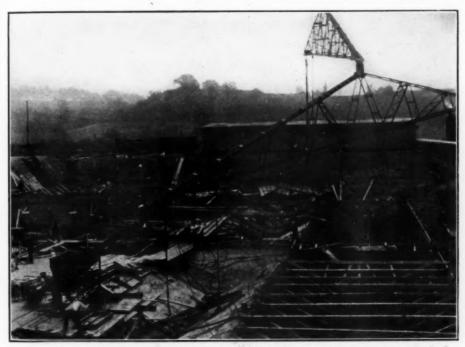


FIG. 6.—FORMS FOR IMHOFF TANK BOTTOM IN PLACE AND POURING UNDER WAY

condition so as to offer mechanical bond to concrete poured subsequently. Reinforcing steel was next placed. This was supported on precast concrete blocks and piers set in the subgrade.

After the reinforcing steel was all placed and tied the placing of forms was begun. Timber trusses were then placed to line and grade at intervals of 6 feet 6 inches for the full length of the trough. Next, panel forms of the proper length were placed between the trusses as the concrete was poured. Figures 5 and 6 shows details of constructing the troughs.

trough and one complete trough was poured each day. When using this procedure it is important to have the trusses well tied down and to place the concrete so as not to have an unbalanced load on the sides of the trusses.

Protection of exposed surfaces of concrete.

The contract for the construction of the Southerly works provides for the treatment of all exposed concrete surfaces by waterproofing them with iron. By this treatment it is proposed to minimize the absorption of moisture by the concrete, which is unusually exposed to freezing and thawing action, and consequently

reduce the probability of its disintegration.

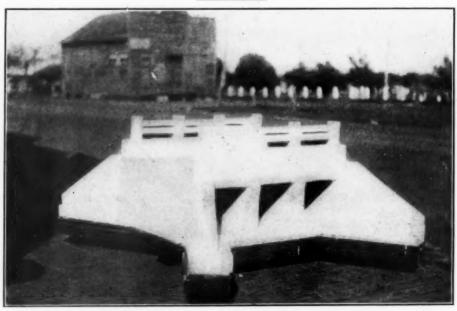
The specifications stipulate that the water-proofing contractor is to take charge of the pointing up and finishing of all surfaces treated by him. In other words, he takes charge of the work after the forms are removed, cuts back tie wires, patches honeycomb and removes all form marks, etc., and is responsible for a smooth finish. The iron is to be applied to prepared concrete surfaces and is to be followed in each case by a thin wash of cement and sand mortar to restore the concrete color. The mortar coat is to be treated or fixed with two applications of fluo-silicate.

The foregoing procedure of treatment was adopted as a precautionary measure. Many cases of serious disintegration of exposed concrete surfaces have been observed recently on sewage- and water-plants and in some instances this has occurred in a comparatively short period after completion of the structures. In some of the structures it is known that the concrete was made and placed in accordance with accepted present-day methods and with good materials. While engineers have generally accepted the necessity of protecting steel

and wood structures by painting, apparently they have stood by and watched "permanent concrete" disintegrate, with little attempt at preservation. It is appreciated also that the true value of any waterproofing material or treatment can be demonstrated only in time. However, if it prolongs the life of the structures but a few years it would seem that its cost will have been justified. The matter of protecting exposed concrete subjected to varying temperature conditions against moisture well deserves careful consideration.

#### Conclusion

The work is being done by the city of Cleveland under the general direction of W. S. Ferguson, Director of Public Service, and Robert Hoffmann, Commissioner and Chief Engineer. George B. Gascoigne, as Consulting Engineer, prepared the plans and specifications and is supervising construction of the work. The writer, who is associated with Mr. Gascoigne, was in immediate charge of the design and is now Resident Engineer in charge of construction.



THE SMALLEST BRIDGE IN THE LARGEST STATE IN THE UNION

We are indebted for this illustration to Albert C. Cook, who at present is in charge of eleven miles of highway for the state of Texas in Williamson County from Leander to the Travis County line. This smallest bridge is an exact copy of the standard bridge designs of the State Highway Department of Texas. The bridge measures 36 x 44 inches over-all, with a 20-inch roadway, while the openings for the passage of water are 6 inches square. The walls are 2 inches thick, the hand-rail posts are 1½ inches square and the hand-rails are ½ x 3½ inches reinforced with small wire. About 50 pounds of reinforcing steel was need in this small model. The completed bridge was painted with white cement and weighs about 300 pounds, taking four men to handle it

#### Elaborate Ceremonies Marked Completion of First Hole in Moffat Tunnel

Final Hole Shot Friday Night, February 18

PRESIDENT COOLIDGE, by remote control, set off the blast which broke down the last barrier between the two bores of the preliminary work of the Moffat Tunnel, on Friday night, February 8, at 8:10 o'clock, Mountain Standard Time. Elaborate ceremonies in honor of the event were staged in Denver, conducted by Governor William H. Adams of Colorado and broadcast from radio station KOA of the General Electric Company in that city.

the Alps. Its completion will mark the culmination of an heroic struggle for the construction of a trans-continental route through Colorado, running from Denver to Salt Lake City. Construction photographs of the Moffat Tunnel appeared in Contractors' & Engineers' Monthly for October, 1924. This tunnel will open the western slope of the Rocky Mountains to all-year traffic, connecting in the west with Moffat's original railroad below the snow blockage line. On the eastern side, the tun-



TROLLEY LOCOMOTIVE WITH REEL AND BATTERY LOCOMOTIVE AT WEST PORTAL OF MOFFAT TUNNEL

The preliminary tunnel completed by this blast is 8 feet in diameter and has served as an exploration tube and later will be used as an aqueduct to carry water from the high western plateau into Denver. Following closely on its heels is the construction work on the main tunnel, whose dimensions will be 24 x 16 feet.

The Moffatt Tunnel, boring under the Continental Divide, will be 6.04 miles long, the second longest tunnel in the world. It will be three miles shorter than that of St. Gothard under

nel enters the mountain at a point about 50 miles from Denver at an elevation of 9,198 feet. Near the middle of the tunnel the elevation is 9,222 feet, a high point to permit ready drainage. The western portal has an elevation of 9,085 feet. The center of the tunnel is 4,160 feet below the top of James Peak. The grade on the eastern side is 0.3 per cent and on the western side 0.9 per cent. The tunnel passes directly under the Crater Lakes on top of the Continental Divide.



HEAVY INFLOW OF WATER AMOUNTING TO 3,500 GALLONS PER MINUTE ENCOUNTERED WHILE DRILLING FROM THE EAST PORTAL OF THE MOFFAT TUNNEL



TYPICAL ELECTRIC LOCOMOTIVE USED FOR REMOVING MUCK CARS FROM MOFFAT TUNNEL

With the utilization of the proposed Dotsero cut-off, a 41-mile branch railroad to be built from the west portal of the tunnel, the distance from Glenwood Springs on the west slope to Denver will be reduced from 343 to 173 miles. Dotsero and Glenwood Springs are now on the Denver and Rio Grande Western Railroad which goes far south to get around the snow line in the Colorado Ranges of the Continental Divide. In addition the tunnel will eliminate 23 miles of the railroad over Corona Pass, practically all of which is above the timber line on a 4 per cent grade and it will cut down the elevation by 2,406 feet and reduce grades to 2 per cent.

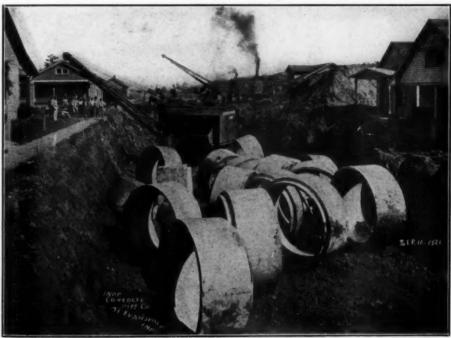
The Moffat Tunnel, in addition to its two railroad tracks will be traversed by telephone, telegraph and power cables, important to the life of the Rocky Mountain section. Automobiles will be carried through on flat cars, allowing motorists to make the trip over the Divide at all seasons. Present automobile highways between eastern and western Colorado cross the Divide by means of passes, which are blocked half of the year by snow. The railroad in the

tunnel will be electrified, electric locomotives hauling the trains. The steam locomotives will have their fires banked and will be hauled through with the trains.

Tunnel construction work was started in October, 1923, under the direction of the Moffat Tunnel Commission and Tunnel District of Colorado. About 4,000 horsepower in electric motors has been and is being used in the west. Motor generators and motor-driven compressors furnish light and power for excavation and constructions. Electric locomotives provide haulage facilities and electric transformers supply power at proper voltages from electric transmission lines. Nearly all the electrical equipment for the work was furnished by the General Electric Company.

The tunnel workmen during the construction work have been comfortably housed in camps at both ends of the tunnel, each camp being stocked with ample supplies of provisions and provided with medical dispensary, hospital, doctor, nurses, etc. The date originally specified for completion of the entire work is July 20, 1927.

#### Large Concrete Sewer Job in Evansville, Ind.



CONCRETE PIPE MADE BY THE INDEPENDENT CONCRETE PIPE COMPANY USED ON GEORGE PON-TARELLI'S JOB IN EVANSVILLE, IND.

#### Construction Features of the Civic Center Development, Lakeland, Florida

By CHARLES CARROLL BROWN Engineering Consultant, Lakeland, Fla.

ONTRACTS for the construction of a unique development for the beautification of the civic center of Lakeland, Fla., were let during the last three or four months of 1926. The accompanying aerial photograph, taken looking west, shows in the center the business district of the city and Lake Mirror, the site of the development. Main Street is

ror, is being widened by a fill in the lake. This fill will cut off a small portion of the lake at the northeast corner. The first lift of this fill is shown in the second illustration. The Northwest dragline excavator is seen building the second lift by excavation of sand from the lake. This contract is an ordinary street contract let to James G. Yeats & Company, of Lakeland



SITE OF CIVIC CENTER FOR LARELAND, FLORIDA

Lake Mirror is seen in the center with the business district immediately beyond it, and in front and to the left
of Lake Mirror is the orange grove recently purchased for recreational purposes

the thoroughfare which, if extended, would pass through the center of the lake. The orange grove on the south and east of the lake has been acquired for park and playground purposes. The new City Hall and the municipal auditorium are seen just west of this park space. A new fire and police station stands near the northwest corner of the lake.

Rose Street, on the north side of Lake Mir-

and Tampa, Fla. The subcontract for the filling is held by Yarborough and Arendell of Lakeland, Fla., who are using a Northwest dipper dragline excavator with gasoline engine, and a 41-cubic-foot bucket handling about 600 cubic yards a day.

For about six feet the material excavated was white sand, and beneath the sand was a red clay hardpan and some soft lime rock. The



DREDGE AT WORK ON THE SHORELINE OF LAKE MIRROR

depth of water was usually about 5 feet, but it increased to about 17 feet for some 50 feet along the fill across the corner of the lake. The area behind that portion of the fill was brought to grade by depositing about 17,000 cubic yards of sand from the lake by hydraulic fill. The roadway and the widening of the existing street required 6,000 cubic yards of fill by the dragline. About 2,600 cubic yards of this was handled twice, as an approach was built first and a portion of this material was moved over to form the base fill for the widening of the existing pavement. The clay was put into the bottom of the fill and the sand on top. The fill is about one-half mile long.

The third illustration shows a close-up of the Northwest excavator at work on another street drainage job, illustrating the flexibility and ease of adaptation to conditions.

At the two points where Main Street approaches the lake, ornamental boat landings, a promenade, loggia, walks and plazas will be constructed. A contract amounting to \$132,-000 for a portion of the work was awarded on December 18, 1926, to H. B. Trauger, of Lakeland, Fla. The major part of the contract is concrete, largely reinforced, with decorative treatment of surfaces and ornamental cut caststone columns and pillars. There will be some 90 tons of reinforcing steel in the structure. Another contract will be let later for the curved street behind a high retaining wall on the border of the lake. This will require some 20,-000 cubic yards of fill behind the wall with the pavement and curb on top. A smaller ornamental plaza will be built under the same con-



CLOSE-UP OF THE NORTHWEST DRAGLINE HANDLING FILL ON THE LAKELAND CIVIC CENTER PROJECT

tract on the east side of the lake near where the high pile of sand is seen on the right of

the second illustration.

The work completed under these contracts will extend from the hotel near the water's edge and east of the municipal auditorium around the west and north sides of the lake, across the northeast corner and to East Main Street extended to the lake, thus making a con-

tinuous drive, with ornamental structures adjoining, from East Main Street, which is the main inlet to Lakeland from the east, around Lake Mirror to Main Street and the central business district. Every traveler by rail or automobile will thus have a clear view of this unique development.

The photographs used in illustrating this article are by Jay E. Brown, Lakeland, Fla.

#### A Contractor's Right to Receive Pay for Uncontemplated Excavation

By A. L. H. STREET

CONTRACT is made to excavate a given quantity, as shown on plans and specifications that define the exact location of the foundation," writes a western contractor. "Excavation is made accordingly, but it is then discovered that the ground is not suitable for the foundation and a much lower elevation has to be reached, involving not only more excavation than provided for by the plans and specifications but also delay of the work to follow and an expense to the contractor not contemplated when he made the estimate on which the contract was taken.

"Is not the contractor entitled to cost of additional expenses, because proper exploration was not made by the owner, because the plans and specifications were based on borings that were supposed to show exact conditions, and because the contractor based his estimate on a given quantity at a unit price, lump sum bids not being called for? The actual cost of the additional excavation exceeded the unit price estimated for the original excavation."

Our correspondent asks for a citation to court decisions bearing on this subject.

If the contractor is entitled to an additional allowance, there is no reason why he should be restricted to reimbursement against the actual cost of doing the additional work. To this cost should be added a reasonable profit for doing the additional work. (9 Corpus Juris, 850-851.) This observation assumes, of course, that there is no special provision in the contract limiting pay for additional work.

Unless the conditions on which bids were received, or the contract terms, were so worded as to expressly place upon the contractor the risk of uncontemplated excavation, the case seems to fall within the established rule of law that "additional compensation may be recovered where the work cannot be constructed according to the plans and specifications furnished, as required by the contract,

but additional work must be done to render the work secure." At page 842, 9 Corpus Juris, and in corresponding annotations, will be found numerous court decisions supporting the last stated proposition of law.

In one of the leading cases on this subject (Faber vs. City of New York, 118 Northeastern Reporter, 609), the New York Court of Appeals decided that a plan furnished to bidders and the contractor for the construction of the foundation of a bridge tower, showing the supposed position of bedrock, was a representation or warranty as to the position of bedrock, rendering the owner liable to the contractor for great additional cost of excavating caused by the mistake. The Court said:

"Clearly, the references to this plan contained in all the parties before us was sufficient to show that the contract was made by both parties upon the understanding and with the supposition that the bedrock was substantially as therein indicated. It would be wholly inequitable to hold that under such circumstances, where the contractor had no reasonable opportunity of discovering the truth, and where the other party had made the examination and asked for bids upon plans showing the results of such examination, the latter can be heard to say that it is not responsible, should those plans wholly misrepresent the facts."

As stated by a New York court (Kuhs vs. Flower City Tissue Mills Company, 171 New York Supplement, 688), "the ultimate guide in determining whether or not there can be a recovery for the extra cost of doing work under a contract is the contract itself. It is always a question of the intention of the parties, and it is this fact which gives rise to the difficulty of reconciling some of the decisions." "No two contracts are exactly alike, and a difference in the language may make inapplicable a decision under some other contract. It may be said, however, that if there are positive

representations in a contract as to the conditions, character or nature of the work amounting substantially to a warranty, there may be a recovery based upon such representations." Citing two decisions of the highest court of the land as having decided the last stated proposition, the New York court adds:

"This may be true even though the contractor was required to make investigations and satisfy himself upon these matters. On the other hand, the representations may be such that it was clearly the intention of the parties that the contractor should rely upon his own investigations and examinations, and in such cases he cannot recover upon the representations."

A leading case on this subject, and one that seems to be particularly pertinent to the specific inquiry here under discussion, was decided by the United States Supreme Court and involved a contract to construct locks and dams in the Warrior river, Alabama. (Christie vs. United

States, 237 United States Reports, 234.) The

substance of the decision in that case is as follows:

The extra expense over what would have been necessary had the character of the material to be penetrated and excavated been such as was represented by the government boring sheets should be allowed to the contractors for construction in an alluvial stream where, the time not being sufficient for the contractors to make their own borings, they relied upon the government borings, which the specifications falsely stated represented "as far as known" the material to be excavated, although such specifications further provided that bidders must inform and satisfy themselves as to the nature of the material.

As to the effect upon a contractor's right to additional compensation for extra work of his having contracted to do the original work on certain unit bases, it is quite well established law that if extra work is of the same character as the original work it should be paid for on the same basis, ordinarily. (9 Corpus Juris, 850, citing numerous court decisions.) But it seems to be equally well settled that where the circumstances make application of that rule inequitable, the contractor is entitled to recover the reasonable value of the additional work, where there has been no agreement as to the rate of compensation for extra work.

Special attention is directed to the case of Murphy vs. United States, 13 Court of Claims Reports, 372, holding that where a contractor was directed to sink a foundation lower than originally contemplated he was entitled to actual cost of the additional work, plus ten per

cent profit.

To the extent, if any, that the subsequent work was necessarily delayed, it seems that the contractor has a valid claim for damages, if any, directly and naturally resulting from breach of the owner's express or implied representation that the foundation could be constructed at the originally contemplated depth. (9 Corpus Juris, 790.)

#### **News Items**

Full-Crawler Company Changes Name

THE Full-Crawler Company, 519 Clinton Street, Milwaukee, Wis., has announced the change of its name to the Trackson Company, by which it will be known in the future. The change was made in order that the company's dealers and customers might more easily link the company's name with that of its product, the Trackson Full-Crawler for the Fordson tractor. The Trackson Company remains a division of the George H. Smith Steel Casting Company and retains the management, organization and personnel of the former Full-Crawler Company.

#### New Wonder Mixer Distributors

THE Construction Machinery Company, Waterloo, Iowa, manufacturers of Wonder concrete mixers, has announced the appointment of the Hubbard-Floyd Company, 452 Lexington Avenue, New York, as its representative in that territory and the Carolina Tractor and Equipment Co., Salisbury, N. C., as its representative in that state.

#### Water-Tight Concrete

A BOOKLET having the title "Water-tight Concrete" and containing a summary of the results secured by adding hydrated lime to concrete, with particular reference to its value in producing impermeable concrete together with laboratory and field data and comments regarding the beneficial effects resulting from its use, has been published as Bulletin 301 by the National Lime Association, 927 15th Street N. W., Washington, D. C. Copies of this bulletin may be secured free by writing to the Association.

Smith Appoints New Distributors

THE T. L. Smith Company, Milwaukee, Wis., has announced the appointment of John Mc-Neilly, 335 South High Street, Columbus, Ohio, as distributor in the Columbus territory for the Smith line of mixers and pavers. The New Mexico Road Machinery Company, Albuquerque, N. Mex., has also been appointed distributor to serve more adequately the increasing demands in the Southwest.

#### A Hot Asphalt Paving Lute

By W. L. HEMPELMANN Engineer, The Texas Company

It is pretty generally admitted that most of the research work on asphalt pavements has been concerned with increasing the quality of the constituents and the better proportioning of same in such mixtures. The accompanying snapshot shows a simple tool, the proper use of which betters the surface of the smooth-riding, hot asphalt mixture wearing surfaces.

This lute or screed consists of a thin board about ½-inch thick by 6 feet long to which is attached a 14- or 16-foot light handle. The edge of the board is sometimes faced with a very thin metal strip to help maintain a straight-line edge. After the sheet asphalt top

of the lute over the surface in a more or less circular manner. Others move it from the edge of the pavement to just beyond the crown, lifting it and placing it immediately beyond the slight accumulation of the hot surface mixture in the center and drawing it back to the curb. Then the lute is moved one-half its width and the operation repeated until all the hot surface mixture has been luted prior to rolling.

The use of the lute in no sense is intended to lessen the care and thoroughness of raking, but, as indicated above, is intended to additionally smooth out the surface mixture after raking but before rolling.



LONG-HANDLED LIGHT LUTE IN USE AFTER RAKING OUT SHEET ASPHALT TOP

or asphaltic concrete wearing surface mixture has been thoroughly "raked out" in the usual way, the lute is lightly moved over the surface of the hot uncompressed mixture to equalize minor surface irregularities left after raking. The long handle makes possible the luting of the entire surface from the edge of the improvement, except in cases of very wide pavements. In such cases a bridge or other means is used to reach all parts of the surface without standing on or stepping into the hot uncompressed surface mixture.

Some contractors prefer to move the edge

The luting operation is usually handled by the tamper or laborer used in carrying the water-line, and hence requires no adidtional labor.

The proper use of the lute will tend to insure a pavement wearing surface of uniform density and attention to this detail will insure a surface of the proper grade and cross-section. As in so many matters of construction, attention to details frequently "makes" or "breaks" the job and the additional smooth surface obtained by luting justifies the finishing off of the uncompressed surface by this method.

#### Foundation Practice in Eastern United States

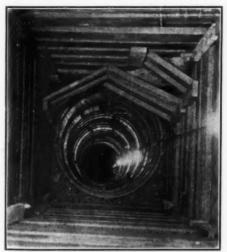
By LAZARUS WHITE

President, Spencer, White & Prentis, New York City

THAT is the hardest job to tackle in the foundation line?" This is a question that might readily be asked in any discussion of foundations. In my opinion, the most difficult job is to start on the foundation when the wrecking operations are begun, with the idea of having the foundation all ready when the wrecking is complete to the curb level, particularly in the case of a new building which is to be considerably heavier than the old one, with columns in entirely different locations. In our operations we have had cases like this, notably one 6-story department store. By the time excavation was down to the curb, the foundations were all ready for the steel and, moreover, the basement walls were extended about 45 feet below the curb. The original construction was built to 15 feet below the curb and in about two months the building was wrecked and work started on the new structure.

#### Caisson Work in the Middle West

The typical wall caisson used in the Middle West in clay foundations, notably in Cleveland, Detroit and Chicago, is rectangular. On some of our Middle West contracts the excavation has been done practically without the use



OPEN CAISSON IN CLAY IN DETROIT, MICH.
At the top of the caisson horizontal sheeting is used.
Below, a circular well consisting of vertical staves and iron hoops is used. This is known as the Chicage well method



RIG FOR SINKING PIERS BY THE CHICAGO WELL METHOD

of timbering. The first floor steel is set and concreted to act as bracing for the walls, and while the steel is being erected the clay is excavated from below and taken out by hoists. By the time the new building is completed the subcellar is excavated.

A new but quite common method of handling clay in the West is to use a small hoist and drag a clay knife through the soil, cutting out the clods of clay, which are loaded into small cars and removed.

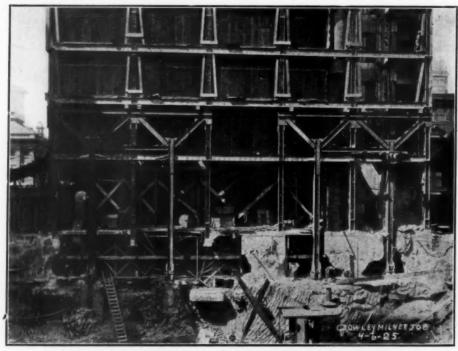
#### Underpinning an Addition

We undertook a particularly interesting underpinning job for a department store which had a very high building and wished to make an addition to the structure. The type of construction was to be changed, the columns were to be differently located, and so on. A truss was erected inside. Meanwhile some of the wells were sunk to the depth required, to hard clay, and a column was tested, together with the footings. There were four specially constructed hydraulic jacks at the base. The column, with its load of about 600 tons, was raised and steel plates were inserted. This had the



TESTING OF PRETEST CYLINDERS BY HYDRAULIC RAMS

The test loads on this job were 75 tons. While the test is maintained the cylinders are wedged to the footing by steel beams. This is a patented method



PRETEST UNDERPINNING THE CROWLEY-MILNER BUILDING, DETROIT The new column loads were transferred to piers in clay by hydraulic jacks

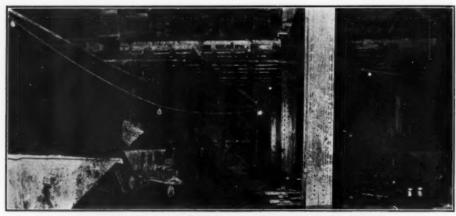


TUBE STEEL POUNDATION OF PLAUT DEPARTMENT STORE, NEWARK, N. J.

Note number of rigs in operation. About 520 steel tubes, mostly 16 inches in diameter, were driven 60 feet below curb to rock on this job



ERECTING STEEL ON CAISSON FOUNDATION, THE HUDSON STORES, DETROIT, MICH. Note absence of bracing. The foundations were placed while the building was being wrecked



EXCAVATION FOR BASEMENT OF J. L. HUDSON BUILDING, DETROIT

Excavation was carried on while the superstructure was being erected overhead. An air-shoven excavated the clay. The vault walls were braced by steel and by the floor at curb level

effect of jacking the caisson down an inch or two. Thus the steel truss was tested and some defective connections found, which were quickly remedied.

Typical New York Foundations

Typical foundations in New York City are steel tubes driven to rock. They are called piles, but strictly speaking they are small steel cylinders about 16 inches in diameter. These piles have the advantage of very heavy concentration. A pile foundation may carry a load of as much as 1,000 tons imposed upon it by a small column base. This has the advantage of placing the footing directly below the load. The accompanying illustration shows the construction of a typical steel pile foundation with the pile-driving rig. There is quite a concentration of plant because in department stores it is always necessary to work against time. On the Hudson Building, in Detroit, the wrecking of the building was started at the beginning of the year and by Thanksgiving the new structure was completed and fully occupied by all the departments. A similar thing was accomplished in Newark, N. J., in the Plaut store. The scheme of using the flooring as bracing for the walls was resorted to and the excavation was started in the basement. This method proved very successful.

Another type of foundation is that in which cylindrical columns are used. These columns are finally tested by hydraulic jacks. If one puts the cylinders too close together, their cones of pressure overlap and bring overloading on the soil in certain sections. One of the cylinders might be tested for 50 tons, but if four jacks were put close together and handled simultaneously, it would be found that the four cylinders would not carry 200 tons, with the same settlement as the single cylinder tested to 50 tons. They would carry only about two or three times as much as the single cylinder, because of the overlapping effect in soil pressure. In order to overcome any erroneous assumptions arising from the testing of single cylinders, it is best to test them in groups. This is a new development in testing the bearing value of soils.

In the footings for the Eighth Avenue Elevated, New York City, which is about the oldest piece of brick work of this type in the United States in spite of the fact that it is only about fifty years old, the foundation is still in very good shape. It seems that pains were taken to excavate to a good bottom although the footings were not proportioned to the loading. Some of the wrought iron anchor bolts which have been in place forty or fifty years are perfectly preserved in the brick work.

Life is like climbing a mountain. If we keep looking to the top we soon become discouraged, but if we pick out an object just above us we soon reach it and can then choose another objective, a little higher up, and before we realize it, the top has been reached.—Exchange.

#### Pile Foundations

By J. WRIGHT TAUSSIG

Vice-President, Raymond Concrete Pile Company, New York City

THERE is little question that the more we study foundations the less we seem to really know about the subject. One can best judge the proper procedure in foundations upon the basis of actual experience. When a certain thing has been done in a certain place and it has worked, possibly because of a great safety factor, one feels a great deal of confidence in doing it again. For that reason, it seems to me that the best guide, and possibly the only definite guide, in foundation work today is experience that has been gained.

In general, the first thing to do on a foundation is to find out what there is to build on. That sounds like a perfectly simple job, but, unfortunately, most people do not do it. A great many people won't do it, even after they have been asked to. If an expensive building is going to be erected, the foundation will cost 5 per cent, or possibly 10 per cent, in some cases. The owners have no information regarding the soil. They are asked to get it. It is too expensive. It costs possibly \$500 to make borings. The owners say they are not needed; they will hire a consulting engineer and he will tell them what to do. Usually the engineer wants to make borings, but the owners still refuse. The result is that probably 90 per cent of the so-called failures or settlements are due to lack of information-not misinformation, but lack, absolute lack, of information.

In some cities today, the building codes require borings. The requirement is not universal. Possibly, that is not necessary, as there are other methods of getting the needed information. Any engineer who designs a structure that must stand up without material settlement or change, should first determine the character of the material that it is to rest on, and with that information before him he can then seek other advice as to how to proceed.

The practical side of determining on the best type of foundation should include finding out what has been done in the vicinity. Usually one can find a building, a similar structure, that is supported on a foundation fairly close to where one is about to build, and a great many people assume that that is the last step in solving their own problem. On the other hand, this feature should only be a guide, as we know that soils vary tremendously. We know that one side of a street is very often not like the other side of a street and we know further that the foundation under a single col-

umn in a building may be rock on one side and soft material on the other. In driving piles, it is often found that under the same columns piles will drive 20 feet, and 5 feet away they will drive 30 feet. For this reason, an accurate study of conditions and the nature of the soil must be made, to anticipate what is likely to be found.

After the preliminary information has been secured regarding adjacent buildings the next thing to do is to decide, either with a consulting engineer or with some other competent authority, what type of foundation is best adapted to the particular need.

#### Foundation for Public Service Structures

In the writer's opinion the safety factors used on public service structures should be entirely different from those on ordinary structures. In the event of a serious calamity, such as the Baltimore fire, the San Francisco earthquake, or the Florida hurricanes, the public service facilities—such as water, light and gas—are not supposed to break down and the structures housing these plants should not fail even though other buildings are destroyed. Therefore, in the construction of foundations, it is well to consider the use for which the structure is intended.

For instance, in building a low, light-weight structure, there is usually no necessity to provide as unvielding a type of foundation as would be required under a structure 500 feet high. Even allowing the same stresses on the piles or rock, because of the relative value of the structure, the relative amount of damage as a result of settlement should be taken into consideration. Again, if there is vibration, or if there are to be moving loads in the building, these should be taken into consideration. Troubles are often experienced in large expensive structures, such as rolling mills and power developments, because of these unusual strains on foundations. It is only by the constant effort not only of the people who are designing foundations but of the people who are building them, that proper consideration of these points are secured.

#### Determining the Proper Type of Foundation

Having determined in one's mind the relative value of the building as regards the foundations, it is usually a comparatively simple matter to decide on the actual type of

foundation. Foundations originally were entirely spread footings. After that came the use of piles, because of the fact that it was necessary to construct buildings above water or in places where the soil was not adapted to spread footings. Piles in some form or other

have been used for many years.

Caissons, particularly deep ones, may be said to carry their loads as do piles and spread footings. Many interesting experiments have been made to show that the weight is not only supported on the base of the caisson, but is often supported throughout its entire length by friction. Piles generally carry their load by friction. With the exception of steel piles, which are really small caissons, probably 90 per cent of all piles carry most if not all of their load by friction. When these piles are developing their friction, certain stresses are set up. In driving a straight-side pile, the angle of thrust which resists settlement is necessarily at right angles with the angle of friction. The vertical component of the thrust, and therefore the supporting power generated, is necessarily increased if the pile is tapered, as is the case with Raymond concrete piles and to a lesser degree with wood piles. A straight-side pile, whether it be concrete, steel, or possibly a caisson, will resist the load put on it up to a certain extent. However, once it moves sufficiently to break the side friction, settlement is resisted only by displacement under the base. On the other hand, a tapered pile in settling under a load increases the displacement throughout its length so that it continues to resist settlement far beyond the point of failure in a straight-sided pile. Many actual tests have confirmed this.

#### More Adequate Information Regarding Soil Necessary

In designing heavy foundations, consideration should be given to the materials underlying the upper strata even though these may have been investigated for 25 or 30 feet. Our experience has shown that substrata, even if at considerable depth, must be considered—

and very carefully considered.

In cities that develop rapidly, sites are used where ordinarily buildings would not be erected, and for that reason we find structures placed over filled ground and on old swamps where the poor soil has been covered up, possibly by the glacial drift but usually by man at some fairly recent time. These underlying strata of poor soil must be considered. If the subsoil, possibly as much as 50 feet below the surface, is overloaded, there is little question that settlement, and perhaps serious settlment, will occur. This, I believe, is one of the most serious dangers to look out for in foundation work. Many people design a foundation without taking this into consideration and then feel greatly surprised when trouble occurs.

#### Equipment Foundations for Power-Plants

By ROBERT A. MARSHALL

Supervising Engineer of Shop Equipment, B. M. T. Lines, New York City

OUNDATIONS for power-plants require the most careful study of soil and loading conditions to insure the safety of the expensive equipment and its continuity of operation. Mechanical engineers have been making steady improvement in the last twenty years in the equipment of power-plants, extending from the horizontal reciprocating engine with mass foundations to the modern steam turbines of large capacities, which are frequently supported on steel frames in order to supply space below for condensors and auxiliaries. Boilers have grown from units of 200 to 300 horsepower to over 2,000 horsepower. Steam pressures and coal handling have kept pace with the boilers and generating units.

In the initial design of a power-plant it is customary to allow for growth by providing space for future additional units. It is frequently necessary to build the foundations and housing for these future units with the first installation. It is not possible to forecast what the future units may be, hence the engineer must be a man of vision to plan for the growth of equipment. He must also keep the invested cost within limits which will earn dividends.

The power-house of the Pennsylvania and Long Island Railroad, on the East River in Long Island City, which is now over twenty years old, is an excellent illustration of the results of building foundations for the future. The plant was laid out for a double-deck boiler room, and the engine room contained three 5,500-k.w. steam turbines, the largest that had been built up to that time. Space in the building was also provided for several future units of similar size.

The site required pile foundations, and wood piles were driven over the entire building area, including that for future units. The piles were cut off 3 feet below mean high water and capped with a plain concrete slab 6 feet 6 inches thick. This thickness was found necessary to

distribute the concentrated loads of both building and equipment over a sufficient number of piles to safely suport them. The flumes for intake and overflow condensing water were built at the same time and of sufficient capacity to allow for the future growth of the plant. The original 5,500-k.w. units have long since been discarded and replaced with others of 24,000-k.w. capacity. There are four of these units, and no change in foundations was required for their installation, as the pile and slab foundation provided for any reasonable re-arrangement of equipment and location of new units. Hence, there has been no loss in foundation investment through the change in equipment.

At the same plant there is another interesting foundation, namely, that for the coal tower

at the outer end of the docks. The tower, 165 feet high, contained heavy steam - driven hoisting machinery and was subject to considerable vibration from the hoisting loads of a two-ton bucket which made a round trip in about 40 seconds. The site was found to be mud, overlying sloping rock, and the problem was to put in a foundation which would sustain the tower loads and be stable against vibration. If

the piles were driven to rock, they would carry the load, but there would be no stability to the structure, because of the soft overlying strata.

Under the direction of the late G. B. Francis, member A.S.C.E., a foundation was designed which proved to be an economical solution of the problem. The method consisted of dredging the site almost to rock, building a timber crib which was floated in place and sunk into mud by filling loading pockets. The corner pockets which were under the tower columns were then filled with earth and piles driven in same to rock. The piles and crib were then capped at mean low water and concrete piers built on top. The result was a remarkably steady foundation platform for the tower.

The development of reinforced concrete has been of material assistance in a good many of the foundation designs for industrial plants and power-houses, and the use of reinforced spread footings and continuous reinforced concrete mats has solved many foundation prob-

lems. On one occasion I made an investigation of a power-plant foundation in a Middle West city, where excessive settlement had taken place. The interior building columns, boilers and coal bunkers were supported on continuous basement walls forming the ash and pipe tunnels. The underlying soil was blue clay of varying supporting capacities and in some places had been forced up by the adjacent settlement. After a study of the situation, the settlement was practically stopped by excavating the basement floor, cutting pockets in the foundation walls, in which were inserted steel beams and reinforced concrete slabs spanning from wall to wall. This prevented further displacement of the softer clay and distributed the loads over a much greater area.

Our organization was later called upon to design a second power-plant alongside the old plant. Applying the experience gained in the first plant, a flat reinforced concrete slab placed over the entire The building area. result was a mat or slab which distributed the weight of the structure and equipment fairly uniformly over the entire building area at such a low soil-pressure that the

settlement was negli-

#### A Good Foundation an Invaluable Investment

A careful investigation of soil conditions preceding foundation design is a good insurance policy for the owner. Test pits, borings and loadings, and bar tests are important data for designs. The late George B. Francis used to remark, "The foundation costs 5 per cent to 10 per cent of the entire structure. Why risk 90 per cent to 95 per cent of the investment for a small saving in the foundation?" If we keep that idea in mind, we will protect the owner's investment and our own reputation.

gible.

This type of design has also been applied with success over fill and on soil of low supporting value, for heavy shop equipment. It generally consists of a concrete floor base 8 inches or more in thickness, reinforced in both directions to distribute the concentrated load. It is a sufficient support for the majority of shop equipment but will not, of course, answer for machines requiring pits or heavy mass foundations, such as are used in rolling mills, paper mills, car-wheel lathes, etc., or for steam hammers and similar pieces of machinery which require cushioned foundations and a different type of construction. While this design will safely support heavy equipment, it must not be used where the underlying strata is liable to displacement.

This type of concrete floor base is now being installed in the new Coney Island repair shop for the B. M. T. lines which are being built by the city under New York City Sub-

way Contract No. 4. The designs were developed by the engineers of the Board of Transportation and consist of slabs 8 to 9 inches thick, reinforced both ways top and bottom, with 1/2-inch rods 8 inches on centers. The soil at the site consists of fill placed several years ago over the old marsh. In some places this fill supported test loads of 1,000 pounds per square foot, but the presence of underlying mud left many soft spots liable to displacements. In some of these the floor is supported on concrete piles, which were also used under all parts of the building structure. The floor slab design adopted will distribute the concentrated load of equipment, cars, etc., to the soil at very low pressures. Where a slab construction of this kind is used, the equipment should, if possible, be located in advance of construction to permit the installation of conduits, pipe trenches, and other underground work. Later installations or changes of such facilities are difficult and expensive.

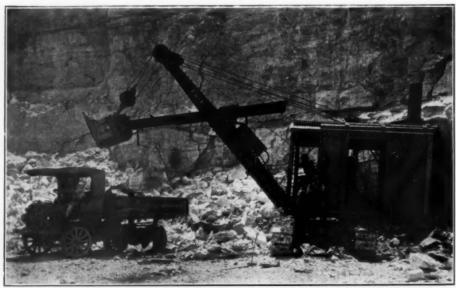
Where spread footings on poor soil are used under building columns, the equipment foundations must be taken into account. A building in Newark, N. J., near the Passaic River, where the engineer had designed large spread footings under the building columns with a soil pressure of 1,000 pounds to 1,500 pounds per square foot. The structure stood up nicely until the owner imposed a row of open-hearth

furnaces above the column footings, with a resulting settlement of about ten inches. If the columns had been supported on piles, the spread footing or a concrete mat could safely have been used under the furnaces. In such cases the equipment foundations must be kept clear of the building foundations.

Danger of Limestone Under Footings

Sometimes the presence of rock under footings may be a cause of foundation trouble. At a large industrial plant in Easton, Pa., clay was above a limestone formation with sink holes and crevices. The clay was found to have a safe supporting value of 3 tons per square foot, and that value was used in footings designs. In each excavation a bar test was made at times with surprising results; the bar would drop out of sight after being driven a few feet into the clay. In such cases it was necessary to go down to rock and frequently into a crevice of considerable depth. Sometimes it was necessary to go down as much as 20 feet, where the crevice and cavities existed. I had occasion to go back to this job a number of years later, and I was told that other industrial plants located in that vicinity had much trouble from settlement because of the lack of exploration such as made by our organization.

ACKNOWLEDGMENT.—These papers are abstracts of oral discussions of the subject "Foundations," at a meeting of the New York Section, American Society of Civil Engineers.



ERIB STEAM SHOVEL IN QUARRY OF H. T. CAMPBELL & SONS, INC., TOWSON, MABYLAND The Autocar truck serving this shovel is owned by H. M. and M. C. Frantz, Cockeysville, Md.

## Contract Control and Engineering Service

By LESLIE R. AMES

State Highway Engineer, North Carolina State Highway Commission

Controlling Highway Funds

Of the annual expenditure of one

billion dollars, for highways in the

United States, approximately sixty per

cent is expended for construction. It

would seem a conservative statement,

therefore, to say that contracts on

highway work to the extent of \$500,-

000,000 are awarded annually. This

large sum, divided as it is into thou-

sands of contracts, makes the question

of "Contract Control and Engineering

Service" a very vital one. This article

supplements most effectively Mr. Ames

article, "Does the State Desire Contrac-

tors to Bid Without Profit" which ap-

peared in the February issue of this

HE state of North Carolina has expended approximately \$125,000,000 in the last five years on construction work. We have found that the most important time to start "contract control" is before the award of the contract. Contractors, bonding companies and state highway departments would save thousands of dollars annually if contracts were awarded only to the lowest responsible bidders. Too often an irresponsible bidder can secure a bid bond from a local bonding agent who considers only the benefit he derives from

his portion of the premium, and this places the state highway official in the embarrassing position of being charged with favoritism or graft, if the irresponsible bid is rejected and the contract awarded to the lowest responsible bidder.

Before awarding a contract, we require a financial statement and an experience questionnaire to be filled out. These statements are carefully investigated and never intentionally is a contract awarded to an irresponsible bidder.

"Working Days" of Contract

magazine.

Formerly our contracts specified that working days would start ten days after the execution of the contract. In many cases, the contractor purposely delayed the execution of the contract, not being prepared to start construction, thus leaving the State Highway Commission without redress. Consequently our contracts were changed to read that working days shall start twenty days after the date the contract is mailed for execution, and this change has settled many arguments regarding the beginning of the working time of a contract. We allow contractors to bid on the number of working days to complete the project, and in the compilation of bids, these working days are figured on a basis of \$20 per day, which approximates the cost of engineering. If the contractor overruns his working time agreed upon in the contract or within such extra time as may have been allowed for delays by formal extensions, a deduction of an amount equal to the actual cost incurred by the State Highway Commission is made for each day that such contract remains uncompleted. This amount is considered as liquidating damages on account of the expense due to the employment of engineers, inspectors and other employees after the expiration of the number of working days agreed upon, and is deducted from the final

Testing Materials

Previous to the large construction program, our state depended upon commercial companies for the testing of its materials. However, when work increased in such tremendous proportions, it was found to be more economical and more satisfactory to establish both a physical and chemical laboratory. These laboratories have been equipped with modern apparatus and serve as a means of rendering valuable service to the contractor as

well as an indispensable guide in directing the work. All stone, sand, water and other materials are tested at the physical laboratory and daily samples of pavement on asphalt projects are sent in to the chemical laboratory to be checked for gradation, quality and density.

Inspection and Coordination

One of the most important elements connected with any large construction program is competent and intelligent inspection. It has been our experience that this can best be handled and supervised by central office control, and operating out of the central office are construction engineers making periodical visits to each project. These men correlate and standardize all work under way in such a manner that the same type of construction and methods may prevail throughout the state. This type of

service is especially important on account of the fact that whenever any state inaugurates a large road building program, contractors are attracted from all parts of the country, which results in many conflicting ideas regarding the

methods of workmanship.

In order that the central and district offices may keep in close touch with the work under way, daily report cards are sent to both offices by the resident engineers, and detailed records are made up from these report cards. If at any time any irregularity occurs or the details appear questionable, the project engineer is immediately notified to correct the difficulty at once. By this method, the contractors' as well as the state's interests are protected. We also have monthly progress reports made up showing working days as the abscissa and the total quantities in the contract as the ordinate. Only the major items of the contract are shown on this report, which is made from the quantities as taken from the monthly estimates. As soon as it is noticed that a contractor is falling behind in his progress, the matter is brought forcibly to his attention and he is requested to report on his future plans for speeding up the work. We have found that this system works very satisfactorily and in the majority of cases brings results. If the work is further delayed, a conference is called between the contractor, the bonding company's agent and representatives of the State Highway Commission.

Provided the contractor is able and willing to proceed, the bonding company can often succeed in ably assisting the contractor, financially or otherwise, and save an actual default. I have in mind a report from one of our construction engineers which was made after visiting a grading project, which read in part as follows: "No mules, no wagons, no scrapers, no money, no progress, no nothing," with the

"nothing" underscored.

Strange as it may seem, we struggled along, foolishly perhaps, with this contractor, and he finally completed the work. He was satisfied, however, at the completion of the work that his services would no longer be required.

#### Defaulted Contracts

Finally, we have the contractor who goes from bad to worse, and it becomes necessary to default the contract. The inside workings of the bonding company are then brought to light. We have had one bonding company in particular with whom it has been a genuine pleasure to work. This particular bonding company has a "trouble man" who is sent direct to the work as soon as notified that a contract is to be defaulted. This man is an engineer

with a wide experience along this line of endeavor, and within a few days after the actual default he will have work resumed in a satisfactory way, saving time and money not only to the state but also to the bonding company. We regret, however, that our experience with some bonding companies has not been so pleasant and it often takes a long-drawn-out and painful operation between the time of the default and the resumption of work.

#### **Engineering Service**

During all these various phases of contract control, engineering service plays an important part. Without satisfactory engineering service you cannot have satisfactory contract control, and the reverse of this statement is also true.

One very important service that the engineer should render, and one that is too often overlooked, is in laying out the work well in advance of the contractor's operations. No matter how capable the contractor or how favorable the conditions, an engineer can delay operations by not having the work laid out well in advance. At times the contractor is responsible for this delay in not giving the engineer sufficient advance notice of his plans. Another cause is often the contractor's inability to make uniform progress, thus making efficient engineering services difficult, if not impossible.

An engineer is educated and trained to be accurate. But even then mistakes are made, and these errors are costly to the contractor in both time and money. Instead of waiting for the contractor to discover these errors, the engineer should check his work promptly in order to prevent delays and the suspension of work, which is costly to the contractor.

The majority of states are divided into construction districts or divisions, and it is very essential that work should be uniform and the requirements the same in each district or division. In practice, this objective is very difficult to obtain. However, a contractor cannot bid on a project intelligently unless he knows in advance the requirements, and it should not be necessary for him to bid higher in one district than another on account of uncertainties of these requirements. This fact, I believe, is a very strong argument for central office control.

#### Cooperation Effects Bid Prices

The question of cooperation with contractors, alone, is of such importance that there is a special committee of the American Association of State Highway Officials appointed to work on this problem. A contractor should be made to feel that it is his right and privilege

to appeal from a decision made by any subordinate to the highest official in the State Highway Commission, provided he feels that he is being required to do work not included in the specifications. It is my opinion, that not only the quality of the work done but also the unit bid prices are materially affected by the degree of this cooperation between the engineer, the state highway official and the contractor.

Well-regulated contract control can be the

means of elevating the standard of performance in the contracting industry, thus enabling honest and competent companies to survive. Then the engineering service as now rendered by most states in cooperation with these companies will result in a better standard and quality of work and in the end give the ultimate pavement that all engineers and contractors are striving to obtain.

ACKNOWLEDGMENT.—From a paper read before the American Road Builders' Association, Chicago, 1927.

## The Most Important Thing in Welding

By S. W. MILLER

Consulting Engineer, Union Carbide and Carbon Research Laboratories, Inc.

FUSION welding is like any other operation, in that any operation can be either a success or a failure. It is true that the manipulation of the welding blowpipe is different from that of a lathe or other machine, but the same principle underlies both operations. Stated briefly, the procedure used must be correct if success is to be desired, and it is a tonce evident that as procedure involves a number of elements, each one of them must be correct if the process is to be successful.

The following elements are essential to procedure, regardless of what is being made: (1) design, (2) materials, (3) methods, (4) operators, (5) supervision, (6) tests. I shall put into as few words as possible what I have to say on each of these elements as applied to

welding.

r. Design.—This must be such as will enable the welder to weld easily and cheaply and to do good work. Designs suitable for forms of joining other than welding are frequently very unsuitable for welding, and it is necessary for the designer to forget the other types of joinings, and to learn to use those suitable for welding.

2. Materials.—These must be such as will result in clear, sound welds, so that both the base metal and the welding rod must be selected with this in view. Also the welder must be considered, because while he may be able to use materials that are hard to weld, and while it might be necessary in some cases to do this, yet for general work this should be avoided, and materials should be selected accordingly.

3. Methods.—This refers particularly to the use of suitable jigs, fixtures, clamps and other tools and to the order and way in which the various parts of the whole operation, including the preparation and finishing, are performed. Any of these things that make it easier to get better work, are an advantage,

and each design should be studied with this in view.

- 4. Operators.—As in all other cases, much depends on the operator, but if he is handicapped by improper design, materials, or methods, the best results cannot be expected, no matter how good he is. I disagree with the idea that the operator is the most important link in the chain. I do not think that any one of the elements mentioned is of superior importance to the others.
- Supervision.—As in any other work, competent and careful supervision is necessary.
   The supervisor should know not only the actual welding operation, but all other parts of the work.
- 6. Tests.-A weld cannot be inspected internally to determine its quality, but it has been amply demonstrated that tests can be devised that will prove the integrity of the welded structure, provided the other links in the chain receive the proper attention. There are many other structures to which the same statement applies. One of the best illustrations is concrete. There is no way of inspecting the interior of concrete, and procedure control in its construction is necessary and has been carried to a very high degree of development. The testing of concrete structures is done in practically the same way that welds are tested, by applying a test load of more than the normal working load, and it has been found by experience in both concrete and welding work that when the procedure is proper, safe results are always obtained.

Procedure control in welding has shown its value in many cases not only in better work, but in reducing the cost and increasing the production. I strongly believe that it is the most important thing in welding.

ACKNOWLEDGMENT.—From a paper read before the International Acetylene Association at Chicago, Ill.

## A Report on the Cuban Hurricane of October 20, 1926

By NORMAN M. STINEMAN

THE violent hurricane which devastated western Cuba and the Isle of Pines on October 20, 1926, passed in a general direction from southwest to northeast, the center of disturbance passing about 15 miles southeast of Havana, midway between Havana and Guines.

The movement of the wind, as in all hurricanes, was counter clockwise about the storm center, so that Havana was struck first from the east. As the center moved northeastward,

the wind at Havana shifted to the northeast, and later blew from the north and northwest. It was during the latter phase, when the wind was coming from the north and northwest, that the greatest destruction occurred, for, in addition to the rain, the wind then was heavily laden with sea water. It was during this phase also that the wind blew hardest, from about 9:30 to about 11:30 A.M.

The velocity of the wind is not known, for the aerometers at the National Observatory were blown away when they registered 96 miles an hour. The velocity grew considerably higher after the destruction of the aerometers. The consensus is that the storm was of a severity equal to that of the Florida hurricane of September 18, 1926.

As in the Florida hurricane, the probable force of the wind expressed in pounds per square inch can be estimated only after a complete analysis of the theoretical lateral resistance of the structural frames of buildings which were exposed for nearly all of their height. Not all buildings in Havana are designed for the same wind pressure. One engineer said his firm designs for an assumed wind pressure of 30 pounds per square foot but that the city building code is not specific on this point and the building department is known to have accepted designs that were computed for a pressure less than 30 pounds. Some

impression of the force of the wind may be obtained from the accompanying illustration, showing a 2 x 4-inch timber which has penetrated the trunk of a royal palm.

General Destruction

The general destruction of crops, orchards, trees and shipping was enormous and the same was true of buildings in the smaller cities, towns and villages. Much damage occurred to the sugar crop and to the sugar industry in

general because of the quite extensive destruction of the sugar mills. Harbor structures at Havana, such as docks and piers, are of two general types. The older structures are of wood, many of which were either completely or partially destroyed. The newer type of water - front structures, in compliance with a Federal law that applies to all harbor work in Cuba, are supported on reinforced concrete piles, over which are substructures either of reinforced concrete or of structural steel encased in concrete, with the former predominating. Among the structures of this newer type neither substructures nor superstructures suffered pany damage at all.

Wooden superstructures on the docks and wharves were quite generally either damaged or

destroyed. Most notable among them is the Atares Warehouse owned by the American and Cuban Terminal Company. The main warehouse and auxiliary buildings, all of which were of wooden construction with corrugated iron roofing, were completely destroyed.

Among the reinforced concrete piers and walls, none of which suffered any damage, are the San Francisco Pier, the Machina Pier, the Santa Clara Pier and the Ward Line Pier. A reinforced concrete ocean-front structure that deserves special mention is the twin-pier structure of the Havana Yacht Club, at Marianao Beach. These piers, which were built on the



SHORN OF ITS BEAUTY BY THE HURRI-

This royal palm was stabbed by a piece of 2 x 4 timber during the hurricane which swept western Cuba en October 20, 1926 WRECKAGE OF THE ATARES WAREHOUSES OF THE AMERICAN AND CUBAN TERMINAL COM-PANY, INC., IN HAVANA

These warehouses were built of wood and corrugated galvanized roofing tile. The five undamaged reinforced concrete chimneys of the Havana Electric Light and Power Company are shown in the background



ocean-front and had no breakwater or harbor protection at all, suffered no damage. The Yacht Club building, a reinforced concrete structure, also suffered no damage.

#### Chimneys

Tall reinforced concrete chimneys have made a praiseworthy record in this storm, whether considered from the standpoint of their own performance or in comparison with tall brick chimneys and steel stacks.

Many reinforced concrete chimneys have been built in Cuba. The General Concrete Construction Company of Cuba has alone built no less than 135 concrete chimneys in Cuba, 22 of which were in the storm area and none of which were damaged in the slightest degree. Ten others have been located, making 32 reinforced concrete chimneys in the storm area which suffered no damage whatever.

Brick chimneys failed to perform in a creditable manner. Records disclosed at least eight large brick chimneys destroyed, one badly damaged and one slightly damaged, although the total number of brick chimneys in the storm area is certainly no greater and probably not as great as the number of concrete chimneys.

#### Quality of Concrete Work in Cuba

Interviews with American engineers in Cuba would indicate that concrete as a rule is of no more than fair quality in Cuba due to somewhat inferior aggregates. It is their opinion that more than ordinary care is required to get a good product. The sand used is largely ocean-beach sand, and gravel comes from the same source. Some river sand and gravel is used, but the river product sells at a higher price in the market without producing better results.

The Frederick Snare Corporation of New York City, one of the large construction companies operating in Cuba, conducted some tests from which they obtained the best results with a mixture that varied to some extent, but averaged about as follows:

41/2 sacks of cement

6 cubic feet of fine Terara white sand

6 cubic feet of quarry grits

16 cubic feet of crushed stone, one-third of which was

#### Old and Modern Buildings

Buildings in Havana and vicinity must for the purpose of study be divided into two general classes, namely, those built before the days



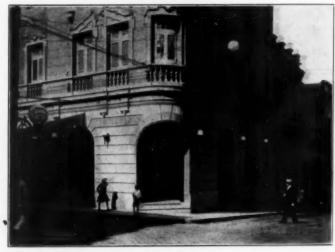
WARD LINE PIER IN
HAVANA, ONE OF THE
BEST EXAMPLES OF REINFORCED CONCRETE
WATER - FRONT CONSTRUCTION IN HAVANA
HARBOR

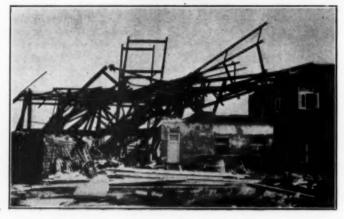
It was this pier that laid up the 6,000-ton steamer "Barcelons" when this ship crashed against the pier during the hurricana. The pier did not suffer the slightest damage.



HARBOR WRECKAGE
THROWN UP ON THE
WHARVES OF HAVANA
HARBOR DURING THE
HURRIGANE

DETAIL OF HOTEL ASTOR, A 10-STORY REIN-FOR CED CONCRETE BUILDING IN HAVANA This exterior is typical of modern buildings in Havana. The exterior of the first floor, the entire front and the end bays of the long side are smooth pertland cement stucco marked off in courses. The moldings are cast in place. The remainder of the exterior is rough-cast portland cement stucco





STRUCTURAL STEEL
PRAME OF A FOURSTORY APARTMENT
BUILDING UNDER CONSTRUCTION IN THE
VEDADO DISTRICT OF
HAVANA



TYPICAL DESTRUCTION OF OLDER FORMS OF CONSTRUCTION ON COMPANARIO STREET NEAR MALECON DRIVE, HAVANA, ALONG THE OCEAN FRONT

These structures are of native stone. Failures of this nature were far more frequent in the smaller cities and towns than in Havans, where most of the damage was confined to parapet walls and accessories, such as balconies and shutters

of modern development in Cuba and those built either by American interests or as a result of their influence. The older office and business buildings are as a rule not more than five stories high, while most of them range from two to four stories. In fact, the height regulations, while very complicated, work out in the final analysis so that buildings higher than five stories can be built only on a small number of streets. Buildings as high as ten stories can be built only on a few wide streets or in districts where such heights are specifically permitted.

Individual story heights are much greater, however, than in corresponding buildings in the United States. The third story of the 5-story Manzana de Gomez is 17 feet from floor to ceiling, so that the total height of the building is equivalent to about seven stories in the United States.

The older buildings are of very heavy construction. In the two-story building in which the offices of the Frederick Snare Corporation are located, the first-story wall of native stone is about 24 inches thick and the second-story wall is 20 inches. This old masonry is not of particularly good quality, but its dead weight provided good resistance to the storm. Invariably the exterior of the old buildings is coated with stucco, which prevents weathering. The weight of these old buildings, their low height and their uniform heights are all important factors in confining hurricane damage largely to parapet walls and accessory parts of buildings.

Many of the older dwellings, like the older office and mercantile buildings, are built of native stone masonry, also coated with stucco. In fact, it may be said that all buildings in Havana are coated with stucco, for the number not so treated is negligible. This stucco or plaster formerly consisted of a mixture of lime, clay and sand, the mixture now used being portland cement, lime and sand.

The floor surface in buildings of all types is

ROCK STORAGE BUILD-ING AT THE PLANT OF THE CUBAN PORTLAND CEMENT COMPANY NEAR MARIEL, CUBA

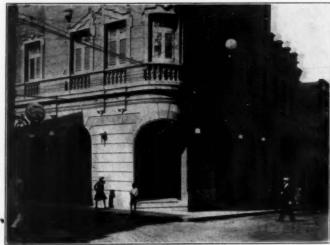
Most of the corrugated asbestes roofing was blown of this building in the hurricane of October 20, 1926. The building had no wall covering

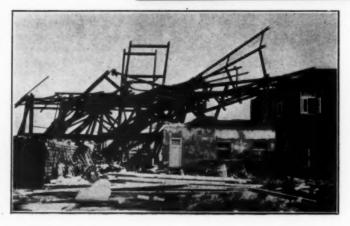




HARBOR WRECKAGE
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Most of the corrugated asbestos roofing was blown off this building in the hurricane of October 20, 1926. The building had no wall covering



almost invariably of tile, either clay tile or cement tile. Flat roofs are usually surfaced with a flat tile and sloping roofs with Spanish tile. The latter type was in a number of instances blown off during the hurricane, but the sheathing remained in place.

Shutters and Close Spacing Were Important Protection

Buildings in Cuba are invariably fitted with shutters on all windows. This is a detail which helps greatly in minimizing the effect of a hurricane, for the shutters keep the wind out of the interior of the building. If windows are smashed, the building at once becomes a pocket for the wind and something must give way. People in Cuba expect a severe hurricane every seven or eight years and they build accordingly. Even the modern buildings have shutters on all windows. For illustration, the windows in the rooms of the Sevilla-Biltmore Hotel have an opening 44 inches wide and 96 inches high. The sash is in three parts, each 141/2 x 98 inches, two of them swinging as a double leaf on one side and one on the other. Each part of the sash has a panel within it, 9 x 88 inches, fitted with adjustable wooden shutters on the outside and a swinging glass panel on the inside. Shutters may consequently be adjusted to admit light and air and at the same time shut off the direct rays of the sun. In the event of a storm, the shutters form an excellent protection against breakage of glass.

Another feature that helps to protect buildings of the older dwelling house class from the effects of storms is their close spacing. Blocks and blocks of the older buildings are built in solid rows with only party walls between them. The damage to these well-shuttered houses usually is confined to accessory parts. In the modern residential sections of Havana, the

dwellings are, of course, detached.

Modern Buildings

Modern buildings in Havana range in height from five to ten stories. Like their predecessors, all modern buildings of architectural pretension have their exteriors finished in stucco. The effects are wonderfully pleasing, as shown in the detail of the Hotel Astor, a ten-story reinforced concrete building, depicted on page 8t. In this detail the moldings are cast in place and the balusters are precast. The first story and

corner bays are smooth stucco marked off in courses, and the remainder of the exterior is a rough cast stucco.

Almost without exception, the modern buildings in Havana have either a reinforced concrete structural frame or a structural steel frame encased in concrete, the proportion being about 40 per cent of the former and 60 per cent of the latter. In not a single instance did a reinforced concrete building suffer any structural damage whatever. This applies to the areas outside Havana as well as within the city.

Completed steel frame buildings of the office and residential class, where the frame is encased in concrete, likewise suffered no damage. However, a four-story apartment building of the steel frame type under construction in the Vedado District of Havana was completely destroyed. This is undoubtedly due to the large area within the building exposed to the wind.

Types of Buildings That Failed

Mention has previously been made of the quite general failure of wooden buildings, such as warehouses and sheds along docks. Wooden structures in general seem to be too light to offer successful resistance.

Brick walls likewise failed quite extensively. The clay brick available in Havana is of rather poor quality and the many failures of brick walls and entire buildings of that material mark it as unsuitable for this locality. At the Toledo Sugar Mill most of the brick curtain walls were blown out, a feature which seemed to mark most of the buildings of this type.

Another type of structure that suffered extensive failure is the so-called steel mill building, consisting of transverse steel bents, not fireproofed, and curtain walls or wall covering of one of various kinds. This type of structure is used quite generally in the larger sugar mills.

The severity of the hurricane at the plant of the Cuban Portland Cement Corporation may be judged from the rock storage building shown in the accompanying illustration taken just after the storm. Some forty bungalows for the employees of the cement company were also seriously damaged, only one out of the entire group, in which a child was born two days before the storm, having been spared. The undamaged bungalow is of portland cement stucco on metal lath and wood sheathing.

Other data and illustrations of the effects of the Florida hurricane will be found on the following pages and also in the November, 1926, issue of Contractors' & Engineers' Monthly, on pages 68-69

## Small Building Construction as Affected by the Florida Hurricane

Based on Observations Made by Louis Brandt for the Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

HILE the storm area of Florida suffered great loss, the damage is not irreparable by any means. Building losses are quickly restored. Those due to the Florida storm can be taken as a valuable lesson to construction men and every section of the country can benefit from these observations. In this report, small building construction is the principal type discussed, as there are found the losses which represent the greatest burden. With the exception of one or two large buildings, the skyscrapers, business structures and hotels of Miami suffered practically no struc-

roof construction alone was a heavy dead load on the walls, and when undue wind pressure came upon them, it brought about a collapse of the entire building. Apparently, little preparation had been made for such additional loads, as this was thought unnecessary in so mild a climate.

In some cases an attempt had been made to build reinforced concrete columns in outside walls to carry the roof loads. Here failure was due to the fact that these columns were started on top of foundations without any studs or steel connections. The amount of steel used.



HOLLYWOOD, FLA.—RUINS OF A POORLY CONSTRUCTED GARAGE BUILDING
Wooden trusses and tile walls with slender reinforced concrete columns. A large number of cars under the

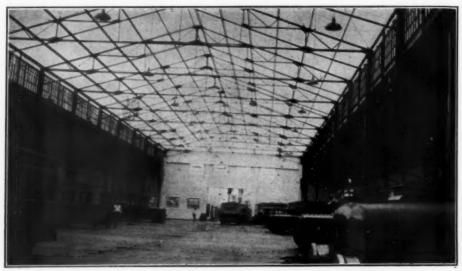
tural damage, as these buildings, as a matter of necessity, were well designed, employing sound engineering and competent workmanship.

Types of Buildings Destroyed

It was found that several types of buildings had been entirely destroyed. Especially noticeable among these were the one-story commercial garage buildings. These buildings in most cases had trussed roofs so as to eliminate column supports within the building. The truss

wholly inadequate from the standpoint of proper design, consisted of but three or four small rods running to the top of the column or plate line. The concrete blocks in this construction were built not into the column, but merely thereto. When the panel blew out, the wind got under the large roofs and lifted them off, bringing about the collapse of such buildings.

Cement Block Construction
Cement blocks in house construction stood



MIAMI, FLA.—A WELL-DESIGNED STEEL FRAME GARAGE BUILDING Roof sheeting blown off and a few tile missing from the end wall, but no other apparent damage

fairly well, except where parapet walls blew out. These failures could have been prevented to a great extent if more care had been used in bonding, coping, etc. Where those walls blew off, the roofs were not strong enough to withstand the load, thus bringing about the collapse of the buildings. Other types of tile-block masonry construction also showed failure, but as cement blocks have been used so extensively throughout the country and should not be condemned, the writer has dwelt on this type of building unit. However, cement blocks must not be considered a "foolproof" building material, by any means. They require as careful application and competent workmanship as steel, brick, stone, reinforced concrete, wood construction, or any other proved material.

#### Wood Construction

While it has been stated quite generally that good carpentry stood the test well, this was not true except where buildings were new and the wood had not begun to decay. It was observed that some wood, especially second-growth lumber, had decayed very rapidly in this climate. This decaying began where the wood studding joined at the sills and joint bearings of the first floor; also at corner connections that had not been protected by water-tight covering of either wood or water-proof stucco. Apparently, as is often the case, nei.l.er care nor discretion prevailed in selecting wood for the structural part of the frame buildings, it being considered that

any old thing was good enough if covered. This has been the practice too frequently of late years in the framing work of our small houses everywhere.

While stucco exteriors were most generally used, either over masonry construction or woodframe houses, a great many small houses were built entirely of wood, that is, with clapboards or other siding for outside wall covering. In view of the recent storm this practice is not to be recommended in this climate, as it is almost impossible to make such structures water-tight, especially around window and door openings. If wood is desired for outside wall covering then it would undoubtedly be better to use wood shingles, as the size, shape and overlapping of the shingles would make a water-tight job, and the shingles if necessary, would be flashed around openings.

#### Reinforced Construction

Almost all the wood-frame buildings having stucco exteriors, with stucco put on over wood-lath composition or fibre wall-boards, failed, as the wind pressure racked and twisted the structures, thus breaking the keys or bonds which are employed to hold the stucco slabs in place. In some cases poultry wire was put on over these materials, effecting a tying together not only of the stucco base, but of the entire structure. This tying with wire demonstrated its value, although wire with hexagonal mesh showed no reinforcing protection.

Most of the frame buildings that stood the storm test were those built of studdings spaced 16 inches on center, properly doubled at openings, with wind bracings cut into the studdings at corners and then diagonally strip-sheathed, which involves the use of lumber 1-inch thick by 4 or 6 inches wide nailed diagonally over the outside of the studs and spaced from 6 to 10 inches apart. This type of construction resulted in a well secured and well-braced frame-Over this framework a 2 x 2-inch paper-backed rectangular mesh of heavy-welded wire reinforcement was placed, with the joints well lapped so as to effect a continuous covering over the structure, thus binding and tying the entire building together. When stucco was applied, this wire mesh became an integral part of the slab, thereby bringing about, in addition to structural advantages, complete reinforcement of the cementing materials.

It has been generally accepted in building practice that if a substantial foundation has been built and a good roof placed over the structure, almost any type of superstructure will give lasting service, provided it is built of such material and in such a way as to resist the elements of cold, heat, rain, and wind pressure. In this respect, Florida, because of its mild climate, does not give sufficient consideration to foundation work.

#### Foundations

Two courses of cement blocks laid almost on top of the natural surface were thought sufficient for foundation purposes as there were no frost disturbances to be met. Foundations thus built failed, on account of the undermining soil and sand movement caused by rains. In future building, consideration must be given to foundations by placing them deep enough in the ground to overcome the defects mentioned.

It appeared that houses built in this climate would be more satisfactory to the occupants if the first floors were at least 30 inches above grade level. Foundations should be built to a depth of at least 24 inches in the ground, and walls to the first floor supports should be built just as substantially as has been found necessary in the frost area. In some locations these walls should be reinforced and provision made for securely anchoring the base or superstructure to the foundations, whether built of masonry or frame construction.

#### Roofing

If figures were available to show which item of construction was more responsible than any other for direct and indirect losses, roofing would show very high in the percentage. Almost every kind of roof suffered. Tile, which is one of the oldest and best types, was in many instances blown off, because of its being open and depending much upon its own weight to hold it in place, with but one nail employed to keep the tile from slipping. The hurricane winds got under this tile and raised havoc. Where tile was laid on and closed up at the ends with cement, it withstood the storm.

Wood shingles stood best where they were properly applied, because of their rigidity and overlapping application. Rag felt, asphalt, and stone surfaced shingles withstood damage where they were cemented at the butts. Built-up roofs stood up well enough where they had been so applied as to keep the wind from getting under them at any point. A study of roofs discloses that the hip or conical-shaped roofs suffered less than those with gables, or flat or parapet walls. In any event, every type and design of roof construction needs secure anchoring to main walls.

#### Recommendations

1. Foundations for house construction should be built to meet any local emergency. Depth of excavation should be not less than 24 inches and in all cases deep enough to secure solid soil. Monolithic or poured concrete will make a secure foundation, having the base-or what is known as the footers-about 6 inches thick and 18 inches wide. On top of this, build the concrete wall a thickness of 8 inches for frame foundation, and 12 inches for masonry foundation will be sufficient. Foundations should be carried to a height of not less than 30 inches above finish grade, with sufficient vents on the four sides to effect circulation of air under the first floor. Provision should be made, in finishing the top of the foundation, to anchor the superstructure of the building securely thereto by means of bolts bedded in the foundation, so that sills, especially for frame work, can be secured with the bolts spaced not less than 6 feet apart. If the load bearing of the soil is uncertain then reinforcing rods should be used in the footers and in some cases in the walls also.

2. The superstructure walls of the building above foundations should be constructed to withstand hurricane and storm conditions. Only weather-tight, water-proof walls, as well as metal weather-stripped doors and windows, should be used. If buildings are constructed of wood, or are of what is commonly known as frame construction, the structural parts thereof, such as sills, joists, studdings and rafters, should be from first-growth lumber from virgin timber and not from the second-growth com-

mercial stock that is now so universally offered on the market. The studding frame work of outside walls should be wind-braced at all corners. Sheathing over the outside of studding, whether of the strip or solid type, should be placed diagonally over the studs to bring about complete bracing. If wood exterior, either shingle or clapboard, is used, it should be underlined with heavy water-proof building paper. Houses having wood covering on the exterior walls should be flashed securely around the windows and doors. Water-proof stucco exteriors are more suitable in this climate, from the standpoint of good effect, and can be made weather-tight around door and window openings and actually cemented in place, but in no event should stucco be used on wood frame construction except with a reinforced base made of 2 x 2 rectangular-mesh galvanized wire, which it was found stood the storm test.

If walls are to be built of masonry with hollow-tile or cement blocks, only that material which has been properly manufactured and which will withstand a crushing test of not less than 1,250 pounds to the square inch, should be considered for use. Hollow-block walls must also be covered with waterproof stucco to prevent leakage and, while these walls have air cells, they will not prove entirely satisfactory unless furred off on the inside, providing a continuous air space between the interior plaster and the superstructure walls.

3. Roof framing should be securely anchored to the superstructure walls. In the case

of masonry, bolts should be built in to the top of the wall, to secure the plates for rafters and the rafters spiked thereto. The rafter framing should be of timber of sufficient strength and spacing to stand hurricane wind pressure. The minimum requirements for small houses would be 2 x 6 material, spaced not less than 16 inches on center, covered with 7/8-inch sheathing, double-nailed to all rafters. Cornices, whether of the open or closed type, should be so constructed that there will be no leakage or chance for wind to get under the main roof. The investigation showed that wood shingles could be safely used; also asphalt stone-surfaced shingles, when properly cemented or secured at the butts. A means of closing the ends of tile roofing and of more strongly securing it, will have to be employed to make this type of roofing hurricane proof.

It is to be recommended that the minimum of of sheet metal be used for roof flashing, as ordinary tin or galvanized iron disintegrates very rapidly in this climate. Copper or zinc should give a lasting service and, because of the small amount of sheet metal required in the

average house, will justify its use.

4. First floors of houses or living apartments should be elevated not less than 30 inches above finish grade and provision made for free circulation of air under first floors. This is important to prevent dampness during the rainy season.

ACKNOWLEDGMENT.—Extract from "Lessons of the Storm," copyrighted, 1926, by the Jones & Laughlin Steel Corporation, Pittsburgh, Pa.



ROME GRADER SUCCESSPULLY UPROOTS 8-INCH TREE IN THE LINE OF MARCH

The front cover of this issue shows this grader as it approached the tree in a grading operation. This illustration shows the result of the attack, illustrating the sturdiness of modern graders and their effectiveness in handling unusual obstructions in opening up new projects

DERRICK BOOM WHICH CRASHED DURING CONSTRUCTION OF THE BUILDING AT 220 WEST 23rd STREET, NEW YORK CITY There was no

There was no loss of life in the accident, and hundreds of pedestrians passed under the boom as it hung most of the day in this precarious position, without realising the hazard above their heads

International Newsreel Photo

## Eighth Annual Meeting of A. G. C. of A.

Unusually Active Meeting Attended by Over Three Hundred Contractors

FROM Monday, January 24, through Thursday, January 27, the Battery Park Hotel, Asheville, N. C., hummed with the activities of the various general sessions and division meetings of the Associated General Contractors of America. Noteworthy among the papers presented at this meeting was that on "Price versus Service in Construction Sales" by Colonel Willard T. Chevalier, Manager, Engineering News-Record, who criticised the present practices of selecting contractors primarily on the basis of price and urged a turn toward selling service first and price second. He challenged contractors to develop better salesmanship. J. T. Haile, Jr., L. T. Wright & Co., San Antonio, Texas, spoke on "What Quantity Survey Has Done for My Chapter." The quantity surveyor has not received the recognition due him in the United States as yet, but with the rapidly increasing appreciation of the value of the quality quantity survey, financed by the owner and upon which all contractors bid, there is bound to be a better understanding between bidder and owner and a material lessening of the great waste of time and effort on the part of contractors in preparing separate estimates of materials for bid-

L. R. Ames, State Highway Engineer, Raleigh, N. C., spoke on the topic "Does the State Desire Contractors to Bid Without Profit?" This paper was abstracted in the February issue of Contractors' & Engineers' Monthly.
G. F. Schlesinger, State Director of Highways and Public Works, Columbus, Ohio, spoke on "Can Highway Reconstruction and Maintenance Be Most Economically Handled by Contract?" An abstract of this paper will appear in an early issue of this publication.

The ever-present difficulties in surety bonding reforms were discussed quite freely and made the basis of a paper by R. H. Towner, Towner Rating Bureau, New York, entitled "Establishing Premium Rates on Contractors' Surety Bonds." Mr. Towner maintained that surety bonds are not insurance, but rather a partnership between the bonding company and the contractor, in which the company becomes a partner of the lowest bidder. Mr. Towner expressed his opinion that in general underwriting is being handled well. There was considerable criticism of Mr. Towner's attitude in the discussion, which brought out the many points on which contractors and those in the position to award contracts sharply disagree with the attitude of many of the bonding companies.

Opinion was divided on the report of the Committee on Materials, which offered for discussion the possibility of collective purchasing of materials and equipment by members of the Association. No definite recommendations were made by the committee, but it was suggested that the Contractors Service Corpora-



GROUP PHOTOGRAPH OF DELEGATES AT THE EIGHTH ANNUAL MEETING

tion, all of the stock of which is owned by the Associated General Contractors, might serve in the capacity of a centralized purchasing department for members of the Association. No definite decision was made regarding the report, the discussion being quite evenly divided.

#### Reviews

#### Motor Vehicles and Their Engines

HIS practical handbook on the care, repair and management of motor trucks and automobiles has been prepared by Edward S. Fraser, American Bosch Magneto Corporation, formerly an instructor in the Coast Artillery School, and Ralph B. Jones, also instructor, Motor Transportation Course, Coast Artillery School, and will be found particularly helpful for contractors owning one or more trucks, whether the care of the trucks is under their immediate supervision or under an experienced mechanic. Every part of the automobile or truck is given a separate chapter, and is well illustrated and described in easily understandable text. Notable among the general chapters are "Engine Troubles Experienced on the Road" and the two closing chapters on care and adjustment, with tables showing just what should be done each week and each month to keep motor vehicles in top notch form. This 434-page volume, which is now in its third edition, is published by D. Van Nostrand Company, New York, and sells for \$3.00.

#### An Instruction Manual on Electric Welding

THE latest edition of an instruction manual issued by the Lincoln Electric Company, Cleveland, Ohio, and revised annually, covering the latest practices in manual electric arc-welding, is of interest to practically everyone who uses arc-welding. Among the subjects treated are

high-speed steel welding, high-pressure pipe welding, automobile frames, boiler repairs, welding cast iron, manganese steel welding, carbon arc-welding, manufacture of machinery and equipment, using welded steel in place of castings. The price of this welding manual is \$1.00.

#### Standard Questionnaire Becoming Generally Adopted

N the annual report of the Committee on Cooperation with the Construction Industry of the Highways Industries Association, Committee Chairman, S. M. Williams, Chicago, Ill., attention is called to the rapid strides made in securing general acceptance of the standard questionnaire by organizations of highway officials and bankers. Among those which have already accepted this questionnaire are the National Association of Credit Men, the Robert Morris Associates, American Banker's Association, as well as the following cooperating organizations which comprise the original Joint Conference on Construction Practices: American Association of State Highway Officials, American Institute of Architects, American Institute of Consulting Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Municipal Improvements, Associated General Contractors of America, Highways Industries Exhibitors Association, National Association of Casualty and Surety Agents, and the Surety Association of America, represented by its Committee on Better Underwriting.



OF THE ASSOCIATED GENERAL CONTRACTORS AT ASHEVILLE, N. C.

#### Items of News

#### Joe Helm Elected President of Asphalt Association

JOE S. HELM, General Manager of Asphalt Sales for the Standard Oil Company of New Jersey, was elected President of the Asphalt Association at its annual meeting. Mr. Helm recently came to the Standard Oil Company of New Jersey from the Standard Oil Company of Louisiana. As President of the Asphalt Association, he succeeds C. G. Sheffield, of New York, who served as head of the organization in 1924, 1925 and 1926. Other officers elected by the Asphalt Association for 1927 were: Vice-President, Leroy M. Law, New Orleans Refining Company; Treasurer, Herbert Spencer, Standard Oil Company of New Jersey; and Secretary-General Manager, J. E. Pennypacker, New York City.

#### Heil Opens New Detroit Office

THE Heil Company, Milwaukee, Wis., has announced the opening of a branch office, sales and service station in Detroit. Roy L. Diercksmeier, formerly manager of the Heil Company's Minneapolis and St. Paul branch, will supervise the organization of the new Detroit district. A stock of steel dump-bodies, hydraulic hoists, hand-hoists and compartment truck tanks will be carried in Detroit, as well as a stock of service parts.

#### New Speeder Factory in Cedar Rapids, Iowa

THE Speeder Machinery Corporation, manufacturers of gasoline shovels, cranes and draglines, has moved its factory and general offices from Fairfield, Iowa, to Cedar Rapids, Iowa. Speeder cranes and shovels are now being built in the new plant, which is a modern shop with upto-date equipment and a present capacity of one complete Speeder every day. This capacity may be easily increased, as the plant is located on an eight-acre plat.

The new factory is of brick and steel construction of the saw-tooth type with a 40-foot craneway over the assembly floor. The entire shop is fitted with an overhead industrial carrier system. The shop and offices are heated by automatic oil-burning superheaters, made by the P. M. Lattner Company, also of Codar Rapids. The heated air is circulated by a fan system. The address of the Speeder Machinery Corporation is 1201 South Sixth Street West, Cedar Rapids, Iowa.

## Wilder Acquires Control of Stockland and Lyle Companies

CONTROL of the Stockland Road Machinery Company and the Lyle Culvert Company, both of Minneapolis, Minn., has been acquired by A. B. Wilder, road equipment manufacturer of that city. Associated with Mr. Wilder in his ac-

tive management of both companies is Cal Sivright, present Vice-President and General Manager of the Stockland company.

The Lyle Culvert Company was organized by Mr. Wilder in 1905. The Stockland Road Machinery Company was also organized in 1905 and was acquired by the Lyle company in 1920. The latter company does a national and foreign business in road machinery as well as a large export business to Australia, South Africa, South America, Cuba, Norway and Canada. Two new units were recently added to the company's main plant in Minneapolis to take care of its expanding business.

#### Armco Culvert Manufacturers Association Opens New District Offices

THE Armco Culvert Manufacturers Association, Middletown, Ohio, has announced the opening of a district office at Lincoln, Nebr., with Mont C. Noble, formerly Chief of Bureau of Roads and Bridges, Nebraska State Department of Public Works, as District Engineer in charge. This office will be in charge of Association work in Nebraska, Kansas, Iowa and Missouri. A district office has also been opened at East Point, Ga., with Tom M. Neibling, formerly Research Engineer, Georgia State Highway Department, as District Engineer in Charge. This office will cover Association work in Alabama, Florida, Georgia, Louisiana, Mississippi, Tennessee, North Carolina, and South Carolina.

#### Oil Jack Company Moves Offices

THE Oil Jack Company Inc., manufacturers of the Pedersen Oiljak has announced the removal of its general offices to 15 Park Row, New York. This company is now in full production on two models of the Oiljak, the JB-3 up to 3 tons and the JB-10 up to 10 tons. These jacks are applicable for use with automobiles, busses and trucks, by builders and contractors, water-works, highway departments, and fire departments, and for many other services.

#### Talbot Becomes Director of Sales for Koehring

THE Koehring Company, Milwaukee, Wis., manufacturers of pavers, mixers, gasoline shovels, cranes and draglines has announced the appointment of K. H. Talbot as Director of Sales in charge of domestic and foreign sales. For five years, from 1919 to 1924, Mr. Talbot was associated with the company as Manager of Field Service. He has resigned as Manager of Cement Sales of the Cowham Engineering Company, Chicago, Ill., to accept this appointment.

#### Kentucky Dealer Wanted

THE Ransome Concrete Machinery Company, Dunellen, N. J., wishes to establish contact with a reliable distributor in Kentucky.

## Caterpillar Fights Mice

This Is Not a White Mule Story, but Tells of a Remarkable Service of a Tractor and Road Grader

AN'S mechanical ingenuity won a hardfought battle against an invasion of mice in Kern County, California, recently and prevented the infestation of several counties by millions of destructive rodents. Starting by the thousands on several fronts, the army of ravenous mice deserted the dry bed of Buena Vista Lake and spread over the countryside, infesting farm houses and buildings, destroying sacked grain, clothing, food and other edible objects in their path. Oil companies and farmers in the immediate paths of the army of mice rushed a Caterpillar tractor attached to a road grader into the field and turned long trenches which were filled with poisoned grain. The hungry mice ate the grain and the advance was checked. Second lines of defense were thrown up, and the most hardy mice reached these before the entire invasion was stopped.

E. Raymond Hall, of the University of California, reported that a count of an average part of the trench showed 84,700 dead mice to the mile during the first days of the war. It is estimated that about 35 miles of trench were turned during the first few days of the invasion. About \$1,000 worth of poisoned grain was used in the trenches.

The origin of the invasion of the mice was the bottom of a dry lake-bed which had been planted to grain. These fields had recently been used as a sheep pasture, and it is believed that



POISONED GRAIN TRENCH S5 MILES LONG, SHOW-ING PILE OF DEAD MICE IN THE FOREGROUND

the mice were starved out. Another theory is that the mice were driven from the lake-bed by rising ground-water, as damp spots have appeared in many places. The enormous number of mice is attributed by experts to plantings of grain and Egyptian corn, which provided a favorable feeding and breeding ground, and to the rapidity with which mice multiply.

Teacher-"Who can describe a caterpillar?"

Tommy-"I can, teacher."

"Well, Tommy, what is it?"

"An upholstered worm!"



THE CATERPILLAR THAT WON THE BATTLE AGAINST THE MICE

This Caterpillar tractor and road grader turned the 35 miles of trench in the path of the invading mouse army.

#### Wickes Now General Manager for Ruggles

THE Ruggles Motor Truck Company, Saginaw, Mich., has announced the appointment of H. Randall Wickes as General Manager, succeeding R. J. Goldie, who resigned. Mr. Wickes

has been Vice-President of the company for some time and is also Vice-President and General Manager of Wickes Brothers and the Wickes Boiler Works.

## Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

#### Assignment of Materials as Chattel Mortgage—New York Liens

On invoices of cement delivered to a contractor there was invoiced an assignment of the cement to a bank to secure loans to the contractor. In the case of Knickerbocker Portland Cement Company vs. State, 217 New York Supplement, 652, the Appellate Division of the New York Supreme Court decided that this assignment was at most a chattel mortgage. And, not being filed as a chattel mortgage, it was invalid as against the statutory lien of the cement company as security for the payment of the price.

#### Two Things That Make Construction Contracts Voidable

One contracting firm said to another, "You get a road-surfacing contract from the state, and we will do the work for you for 90 per ce.it of the price." The second firm agreed. But nothing was said about the nature of the contract that was to be obtained from the state. The state awarded a contract to the second firm, and the first firm was willing to carry out its agreement to do the work for 90 per cent of the price. The second firm said there was no legal contract, and the Oregon Supreme Court decided that the second firm was right in its contention. (Newport Construction Company vs. Porter, 246 Pacific Reporter 211.)

In the first place, the contract between the two firms was void because there was no definite understanding as to the terms of the contract to be obtained from the state.

But the Court declared that there was a more serious objection to the contract than its indefiniteness. The contract was void as being against public policy, because it had a tendency to prevent the two firms from competing with each other for the state contract. The Court said:

"It is not a case where two or more persons openly combine as joint adventurers to bid for the performance of public work. On the contrary, it is an instance where two concerns agree in effect that one shall bid, and the work shall be performed actually by the other at 10 per cent less than the contract price. The conduct of the parties . . . amounts to what is called 'chilling the bids' . . . Any scheme which has the effect of depriving the public of the protection embodied in a statute requiring contracts to be let to the lowest responsible bidder is void."

#### Contractor's Surety Was Discharged by Overpayments to Contractor

County highway construction contracts provided for retention by the county of not less than 20 per cent of all payments for work performed by the contractor until completion of the contract work. The contractor's bonds required retention of at least 15 per cent. Because the county paid in full for parts of the highway as they were finished and accepted, the Indiana Appellate Court decided, in the case of National Surety Company vs. State, 153 North Eastern Reporter, 421, that the surety was released from liability for abandonment of the contracts by the contractor,

The theory of the decision is that by failing to retain part of the progress payments, as provided by the contracts and the bonds, the county increased the hazard of a breach of the contracts by the contractor.

#### Right to Reclaim Things Affixed to Real Estate

It may be assumed that no court would sanction the right of a dentist to reclaim a crown from a patient's teeth without the patient's assent, although the crown may not have been paid for. And, according to a decision of the Massachusetts Supreme Judicial Court (Munroe vs. Armstrong, 60 Northeastern Reporter, 475), a subcontractor who has installed plumbing in a building has no right to remove it without the consent of the owner, although the general contractor may have abandoned the job without paying for the plumbing.

The Court decided that it was a necessary inference from the evidence in the case "that when, as part of the construction of a new house, articles of plumbing were affixed to the structure by a plumber under a contract to put in the plumbing, it was the intention of all parties to the transaction that they should become a part of the realty, as they should be affixed permanently to the structure." And the Court added that whether or not the contractor was insolvent, nothing was "shown to justify a contention that plumbing set in a house under construction, by one who had agreed to do that part of the work of building, could be removed by the plumber upon failure of the owner or contractor to pay for the work."

The principle involved in the decision would

The principle involved in the decision would seem to apply with equal force to the installation of any equipment as firmly imbedded in a structure as plumbing usually is.

## American Steel & Wire Company's WIRE FABRIC

"The Steel Backbone for Concrete"



## Adopted by Municipalities Everywhere

THE public encourages building for permanency, because such construction is always more economical in the end. Many municipal engineers have definitely settled on this point, as may be evidenced by the increasing number of permanent concrete paving programs adopted by municipalities everywhere.

For complete Concrete Slab protection, Wire Fabric has proved itself the perfect reinforcement. Leading engineers specify its use, be- street building project.

cause the closely spaced wires of high strength cold drawn steel insure greatest binding strength, holding the slab together as a solid unit and preventing the development of cracks. Likewise, Wire Fabric has proved its superiority for permanently reinforcing the base under brick, block or asphalt tops.

Furnished in sheets cut to definite size which are easily handled and placed. Let our engineers cooperate with you on your next road or

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WORCESTER .... 94 Grave Street SALT LAKE CITY, Walker I

UNITED STATES STEEL PRODUCTS COMPANT SAN FRANCISCO LOS ANGELES PORTLAND SEATTLE

#### When Delays in Completing Contract Work Are Excused

A sewage disposal plant was not completed within the time required by contract and the litigation in the case of Inland Construction vs. City of Pendleton, 242 Pacific Reporter, 842, followed. As to the contractor's rights, the Oregon Supreme Court decided:

The contractor assumed the risk of encountering more rock to be excavated than was covered by the city's estimate, on which the contractor bid, because the bidders were aware that the estimates were approximate only and that the bidders must investigate for themselves the depth of rock.

So far as delay in completing the work was caused by delay and interference on the part of the city, the city has no right to deduct from the contract price the per diem damages agreed to be paid on the contractor failing to complete the job within the agreed time. But "the contractor has no cause to complain of delay caused by unforeseen difficulties in the excavation of rock and in the laying of concrete, unless the progress of the work was retarded as a result of unreasonable interference and supervision on the part of the city engineer."

## When Contracts Preventing Competition Are Not Illegal

Under fundamental rules of law, the courts frown upon any unholy efforts to squeeze out competition in the contracting field. But the decision handed down by the Indiana Appellate Court in the case of Trentman vs. Wahrenburg, 65 Northeastern Reporter, 1057, shows that it is proper for one who buys an established contracting business to exact from the seller, as part of the contract of sale, an agreement that for a certain reasonable time—say five years—the seller will not re-engage in the same line of business in competition with the buyer. And the agreement may go to the extent of preventing the seller from bidding for public work within that time.

The Court notes that the rule of law that makes agreements to suppress bidding for public work illegal is aimed at those cases where bids are "chilled" in order that contracts may be secured at unduly high prices and the profits be divided among those taking part in the collusive bidding. "By such agreements," remarks the Court, "no one disposes of his business and good will, and agrees not to engage in the business for a certain period; but, remaining in the business, they agree that, as to certain work, competition shall be stifled, and the public shall suffer."

#### Validity of Contractor's Promise to Pay Subcontractor's Employees

A state highway contract was let to defendant construction company, which awarded a subcontract. The subcontractors asked Neal to render certain services in performing the subcontract. Neal declined to do so, until the construction com-

pany agreed to pay him direct for his services, to which agreement the subcontractors assented. The construction company overpaid the subcontractors and declined to settle with Neal, claiming that the company's promise to pay was made on behalf of the subcontractors, and that there was no consideration for an agreement on the construction company's part to pay an employee of the subcontractors. On this point, the company relied on the fundamental rule of law that no promise is legally binding unless there is a consideration for it. But the North Carolina Supreme Court held that there was a consideration—the performance of work which the company had bound itself to the state to perform itself or have performed. (Neal vs. Hagedorn Construction Company, 135 South Eastern Reporter, 120.)

#### When Original Specifications Bind a Subcontractor

A contract to remodel store buildings in Dallas contemplated that the contractor was not to derive any profit upon the actual cost of the metal ceilings to be installed. It specified that the material should not cost more than \$6 per square f. o. b. Dallas, and that "Should cost of ceiling selected be more, the owner will pay the difference; should cost of ceiling be less, credit shall be allowed to owner."

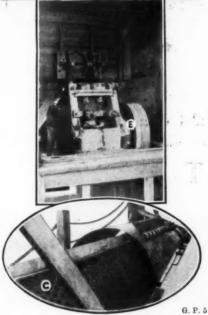
The contractor sublet the metal work to subcontractors to be installed according to the original plans and specifications. The subcontractors paid only \$4.20 or \$4.25 per square for the metal ceiling installed, but concealed that fact from the general contractor and collected from him on the basis of an actual cost of \$6. Holding that the contractor was entitled to recover from the subcontractors, the Texas Court of Civil Appeals at San Antonio said (Watson Company vs. Bleeker, 283 South Western Reporter, 260):

"The trial court denied recovery to the contractor, apparently upon the theory that the contractor was not bound by the specification in the building contract to the effect that the actual cost of the metal ceiling should govern the amount to be paid the contractor furnishing the material, without reference to the estimated cost indicated in the specifications.

"In this holding the trial court erred. By express reference, the specifications in the building contract were made a part of the contract between the principal contractor and the subcontractor, and the stipulation that the actual cost, and not the estimated price, of the metal ceiling should control, was of course binding upon the subcontractor. The fact that the latter, by concealing the true cost, collected upon the basis of the larger and fictitious price, is no reason why he should not be required to disgorge when the true facts were ascertained. When the contractor found that the deception had been practiced he made amends to the owner, to whom he was directly accountable; and he pursued the proper remedy when he called for an accounting from the subcontractor."







The Jonesville Gravel Co., Jonesville, Mich., had a small dredging plant—and a large market. So they put it up to Telsmith to build a plant entirely adequate for their needs. And Telsmith did just that—everything from making the drawings to building the machinery. The plant's present capacity is 1000 cu. yds. per day and it has run steadily and profitably since midsummer, 1925.

In its flow sheet order the equipment is as follows: (A) 24-in. by 5-ft. Telsmith Reciprocating Plate Feeder; (B) Telsmith 3-pulley Belt Conveyor, 24-in. wide x 176-ft. long, with automatic take-up; (C) Telsmith Heavy-Duty Washing Screen, 48-in. x 20-ft.; (D) Two Telsmith Sand Tanks, Nos. 7 and 8; (E) No. 9-A Telsmith Jaw Crusher; (F) Telsmith 2-pulley Belt Conveyor, 16-in wide x 50-ft. long; Telsmith 3-pulley Belt Conveyor, 20-in. wide x 166-ft., 6-in. long (not shown).

Material from screens is delivered to stock piles, various sizes being separated by partitions. Trucks and cars are 'aded by a tunnel belt conveyor, the most efficient and flexible system ever devised, as it is possible to prepare a mixture of almost any percentage or to deliver material unmixed as desired. This conveyor is not shown in the pictures.

Telsmith has the experience, the engineers, complete manufacturing facilities for all equipment from crushers to bin gates—in a single organization of sound financial responsibility. Why not take advantage of Telsmith "Balanced Service?" Write for Bulletin G. P. 21.

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**TELSMITH** 

## A Vibrating Electric Screen for Sand and Gravel Plants

Screen Sash Moves with Same Magnitude of Vibration as Does the Entire Screen Surface

A VIBRATING electric screen for handling sand and gravel with remarkable rapidity has been developed by the Traylor Vibrator Company, 1400 Delgany Street, Denver, Colo.

The vibrating motion of the "Screen Supreme" is produced directly by reciprocating motors and transmitted to the screen sash without change or modification, through rigid members. These reciprocating motors are built into the main frame or stationary part of the screen, one on each side of the main frame and one on each side of the sash and consist each of two main parts, a stator or fixed portion attached to the screen frame and an armature and bar or movable portion attached to the screen sash. The stator consists of electric magnet coils mounted in a laminated iron core. The armature is a laminated core attached to the center of a flexible bar which is fastened at its ends to the stationary screen frame.

The reciprocating motors are operated by a 60-cycle pulsating electric current obtained by adding a small amount of direct current from the DC generator to a standard 60-cycle alternating current of 110, 220 or 440 volts. The amount of direct current so added gives smooth, accurate control of vibration.

Since the moving part of this screen swings freely up and down, its movement always checked by the flexible members of the motors, there is no friction or concussion in its action and the machine operates economically and quietly without wear on any part except the surface in contact with the material being screened.

This screen weighs only 700 to 2,500 pounds and is supported on hanger rods containing a vibration-absorbing cushion. Practically no vibration is transmitted to the support to which the



INSTALLATION OF TRAYLOR VIBRATING ELEC-TRIC SCREEN

screen is fastened so that light construction may be used and the screen installed at small cost. Since the action of the screen is up and down against the load, the abrasion on the screen cloth is at a minimum.

## A Mixer for 1:2:4 Concrete

Machine of Ten-Cubic-Foot Mixed Capacity Designed Specially for This Service



SMITH 10-S TILTER WITH POWER-LOADER AND WATER TANK

THE development of a concrete mixer especially designed to speed up work on concrete of 1:2:4 proportions has been recently announced by the T. L. Smith Company, Milwaukee, Wis.

This is a 10-S machine, with a mixed capacity of ten cubic feet, and while it has been designed to handle a two-bag batch up to 1:2½:4 proportions, it has been especially built with very compact construction so that it may be as easily handled as mixers of smaller capacities. The mixer shown in the illustration is equipped with a power-loader and water-tank. It discharges in 8 seconds and has a daily capacity of from 100 to 150 cubic yards.

# RANSOME



10-S STANDARD BUILDING MIXER

### RUGGED!

The Ransome 10-S Standard Building Mixer—with power loader and automatic water tank—is built to meet the most exacting requirements for speed and durability. Before buying a 10-S, study the outstanding features of the Ransome 10-S.

Large capacity drum — 51 inches in diameter by 39 inches wide, inside measurements. Steel Plate shell and flanged heads electrically welded. Drum Rollers—

car wheel iron, chilled—Timken Roller Bearings — High Carbon Shaftings. Loads and discharges quickly.

And controlled with one set of levers located at the drum end of mixer. Just the mixer you've wanted!

Write for a bulletin to-day

RANSOME CONCRETE MACHINERY CO.

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Ransome Standard Building Mixers

## A New 1-1/4-Cubic-Yard Power-Shovel

#### Equipment includes Over-size Brakes, Clutches, Drums and Other Working Parts

THE new model K-42 power-shovel, designed by the Link-Belt Company, 910 South Michigan Avenue, Chicago, Ill., and which was shown for the first time at the Road Show this year, was developed with particular thought to the kinds of digging and speed of operation which should reasonably he expected from a machine of this capacity, subject to innumerable shocks and strains. The working parts of the new shovel are the drum shells to vary the drum diameter, and by changing the engine pinions. In this way the machine can very quickly and easily be converted from shovel to dragline, crane, trench shovel, etc. A very complete line of popular appurtenances, such as a boom for the dragline or general crane service, trench shovel and skimmer are available for this shovel.

The manufacturer contends that there are jobs



THE NEW MODEL K-42 LINK-BELT POWER-SHOVEL

as large and liberal as in machines sold for heavier duty. It is not, the makers assert, a one-cubic-yard machine "stretched" to 11/4 cubic yards, but rather through its over-size equipment, permits readily of 11/4-cubic-yard capacity operation under the most grueling conditions.

All rope speed changes in the new Link-Belt K-42 shovel are taken care of merely by changing

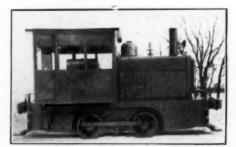
where two-cubic-yard machines are used on which the new Link-Belt 1½-cubic-yard shovel would have shown up to much better advantage, not only in the lessened expense of placing it on the job and keeping it moving along with the job, but also in greater average output and mobility and less loss of time, which are important items when the output and costs are compared.

### A Giant Gasoline Locomotive

Manufacturer Develops 30-ton Unit for Heavy Service

A 30-TON gasoline locomotive was recently purchased by the DuPont Rayon Company from the George D. Whitcomb Company, Rochelle, Ill. This is one of the largest gasoline haulage units that has ever been built, with the possible exception of a type for experimental purposes. This giant Whitcomb is powered with a 6-cylinder, 6½ x 7 Beaver engine, now made by the LeRoy Company, capable of developing 175 horsepower. It has a drawbar pull of 17,500 pounds on low gear without sand.

The frame is of solid type construction, the axle of forged steel, and the wheels of solid-tire type. The transmission allows for all speeds, either forward or reverse, and sand is furnished on all four wheels for better traction when needed.



THE WHITCOMB 30-TON GASOLINE LOCOMOTIVE

Waukesha Engined Haiss Snow Loader in New York



## For Public Service

New York was snow bound in December. Choked traffic meant thousands of dollars loss each day. But New York was prepared to minimize this loss. Their Waukesha Engined Universal Mobile Cranes and Haiss Snow Loaders soon removed the windrows from the thorofares. For economy and reliability it will pay you to choose equipment powered with Waukesha "Ricardo Head" Industrial Engines.

Waukesha "Ricardo Head" four and six cylinder engines are built in graded sizes from 20 to 120 horse power. They may be bought separately or in complete Power Units. Write for "Industrial Applications," a book showing how "Ricardo Head" engines are used in thirty-two different kinds of industry.

(N-701-M)

INDUSTRIAL EQUIPMENT DIVISION

## WAUKESHA MOTOR COMPANY

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Kansas City V. L. Phillips Co. Denver Wilson Machy. Co. Tulsa C. F. Comp Co. Houston
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Exclusive Builders of Heavy Duty Gasoline Engines for Over Twenty Years

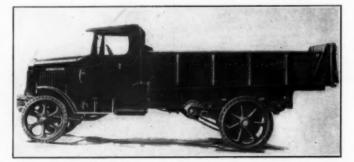
## Two New Types of Four-Cylinder Dump-Trucks

Trucks of 21/2 and 31/2 Tons Capacity Have Chain Drive

TWO new types of four-cylinder dump-trucks of nominal ratings of 2½ tons and 3½ tons respectively, have recently been added to the line of motor trucks manufactured by the International Harvester Company of America, Inc., 606 South Michigan Avenue, Chicago, Ill. The smaller of these is designated as Model 54-C and has a capacity of from 2½ to 3 yards and the larger, designated as Model 74-C, 4 to 5 yards.

The chain-drive appeals to many people because of the simplicity of the chain mechanism, the ease with which adjustments and repairs can be made A simple arrangement for adjusting the tension of the chains is incorporated in the steel radius arms which transmit the torque from the rear wheel to the frame. Adjustment is made particularly easy so that the liability of neglect of chains is greatly reduced, hence lessening the danger of undue wear on chains and sprockets which results from the chains running too tight or too loose.

Other features of the truck are: removable cylinders; worm and wheel steering gear with post carrying wheel at a 32-degree angle and connecting shaft vertical giving a maximum foot clearance,



NEW MODEL
INTERNATIONAL
HARVESTER TRUCK
WITH CHAIN
DRIVE

while the truck is on the job, and also the ability of the truck to pull out of gravel pits and excavations. Both models are provided with a wide range of gear ratios, so that when necessary a maximum of power can be exerted in pulling up steep grades, and at other times a fair rate of speed with a minimum of fuel consumption can be attained on level stretches. The transmission includes four speeds forward and one reverse. In the larger model, in addition to the reduction-gear type of drive, the live axle has a two-speed range which provides an exceptionally wide choice of power application.

comfort and convenience for the driver; and auxiliary rear springs that go into action after the load reaches a certain amount, thereby providing additional cushioning effect with heavy loads. The frame consists of deep double-steel channels, one inside the other, each section being ¼-inch thick, and a liberal number of cross-members that give rigidity to the chassis.

With these two additions, International Harvester trucks are available from the 3/4-ton special delivery to the 5-ton heavy-duty model with a variety of chassis and body types.

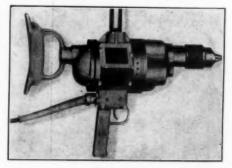
## A New Special Ball-Bearing Electric Drill

Especially Adapted for Contractors, Electricians and for General Shop Work

A N all-purpose ball-bearing electric drill, which the manufacturers, the Black & Decker Manufacturing Company, Towson, Md., state has certain characteristics not available in any tools on the market at the present time, has been developed for contractors, electricians and general shop work of all kinds. The drill comes complete with a combination spade handle and breast-plate, three-jaw geared chuck for straight-shank drills up to 5% inches, 15 feet of duplex electric cable and attachment plug and detachable side handle.

The capacity of the drill in steel is 1/8 to 5/8 inches. The no load speed of the drill is 400 r.p.m., and its net weight 171/2 pounds.

The weight of the drill makes it possible to use it in many positions and on many jobs where heavier drills would not be satisfactory.



THE NEW BLACK & DECKER %-INCH ELECTRIC





THIS season get your repair work out of the way earlier. Reminder: A mixture of "Tarvia-KP" and stone forms an efficient

patching material for any type of road.

Moreover, "Tarvia - KP" goes further
(only 12 gallons needed to a cubic yard of stone).

Send for copies, "Helpful Hints for the Foreman of the Repair Gang."

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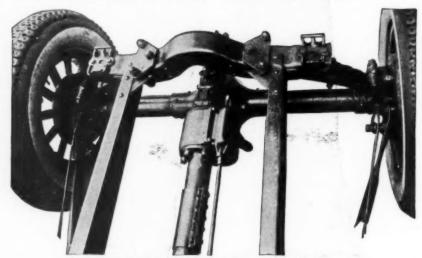
## An Auxiliary Transmission for Ford Trucks

Easily Installed Unit Gives Four Speeds Forward and Two Speeds Reverse

A nauxiliary transmission for Ford trucks which lowers both forward speeds 80 per cent by one movement of a shift lever and which gives four speeds forward and two reverse, has been developed by Fuller & Sons Mfg. Company, Kalamazoo, Mich. In installing this auxiliary transmission, the rear axle is not changed nor is the drive-shaft cut off. Only 5% inches of torque tube is taken out and the transmission is installed in front of the rear axle housing. Being back of the motor and the universal joint, no extra strain

is thrown on these units.

The manufacturers state that the Fuller transmission can be put in place by any good mechanic in from two to three hours. There is no neutral position on this transmission, therefore both Ford brakes are always available. Shifting is done by a simple forward or backward movement of the shift lever and it is possible to shift whether the motor is running or dead and whether the truck is going forward or backward.



THE FULLER AUXILIARY TRANSMISSION FOR FORD TRUCKS

## A Versatile Excavator

New Power-Skimmer for Ditching, Backfilling and Cellar Digging

SEWER and water contractors have shown considerable interest in Pullscoop ditching buckets for trenching work, while road contractors are particularly interested in the Keystone skimmer. The 18-foot boom of this skimmer made by the Keystone Driller Company, Beaver Falls, Pa., gives a 14-foot horizontal crowd and the flat bottom skimmer bucket can be used to finish a grade closely with little or no hand-trimming.

The new Keystone 4-27 skimmer bucket has a three-piece body so that the side plates can be replaced when worn or damaged without the necessity of renewing the entire body of the scoop. The rear hanger is made of one steel casting, a stronger construction, free from the possibility of spreading. The skimmer tolls are equipped with Timken taper roller bearings mounted on an improved equalizing roll carrier.

The crawler or traction lock in this machine consists of a sleeve with a dog clutch on the speed shaft. Controlled by the traction lever when the clutch is disengaged, the crawler is automatically locked. This dispenses with the need of blocking the machine.

The relay chain drive consists of a double idler or relay sprocket placed on the front crawler axle. One stretch of chain drives from the differential sprocket to the idle sprocket and another stretch from the idle sprocket to the driven sprocket on the crawler. This arrangement, according to the manufacturer, eliminates the possibility of the chain jumping off and also makes it possible to operate the crawlers while tilted to any angle.

The Keystone electric bucket-trip, according to the engineers of the Keystone Driller Company, "has a kick like the shot of a gun." By means of this patented electric trip, the shovel runner can drop the bucket load of spoil exactly when and where he likes and it permits the spotting of spoil into wagons with unfailing accuracy.

# WHITE ENTERS LOW PRICE LIGHT DELIVERY FIELD

Announcing Reduced Prices
Placing WHITE Transportation within
the Reach of Everyone

Model 15
34-1 TON CHASSIS

\$2150 ← OLD PRICES → \$2950 NET

\$1545 ← NEW PRICES → \$2125 (ALIACION)

\$605 ← SAVING → \$825

WHITE transportation is today within the reach of every field of business and industry. Because of the increasing demand for quality truck performance, The White Company announces a broadening of its merchandising policy resulting in reductions in the prices of two models of four-speed light delivery trucks.

White is extending its area of transportation service—entering a wider field of fast, light delivery and establishing a complete range of truck capacity and price never before equaled by any high-grade truck manufacturer.

The name and reputation of White is insurance of continued high quality. These are the same high-grade White Trucks—at lower prices—the same standard specifications. For years the four-speed White Model 15 and Model 20 have been the outstanding quality trucks in the light delivery field. No truck of the same size or capacity (¾-ton, 1-ton and 1½-ton) compares with them in dependable, low-cost transportation over hundreds of thousands of miles.

Throughout the chassis construction of the White Model 15 and Model 20 you will find inbuilt quality, ruggedness and exclusive White mechanical features that are not duplicated in any other light delivery truck at any price.

THE WH Please covering prices.												ne	di	eti	c.,
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Terms-Operators wishing to buy trucks on terms can do so

THE WHITE COMPANY, Cleveland

WHITE TRUCKS



THE NEW MODEL 4-27 KEYSTONE EXCAVATOR EQUIPPED WITH PULLSCOOP

The backfiller blade for the new Keystone 4-27 is made to fit any size Pullscoop from 20 to 44 inches inclusive. It is installed by simply taking off the side-rake teeth and bolting on the blade in their place.

The cab for this machine is built of structural steel covered with 22-gage galvanized iron. It has

a roomy interior with a floorway clear around the machine and is equipped with doors both side and rear. The sides are built in sections, any one of which can readily be removed. The cab is weatherproof and serves to protect removable parts against theft. The cab has windows in the front, on both sides, and in the rear.

## New Trench Hoe Attachment for Cranes

Device Opens New Field for Crane Service

5%-YARD trench hoe attachment has been developed for Universal cranes by the Universal Crane Company, Cleveland, Ohio, to further increase the all-round application of these cranes to handle the harder digging jobs not readily adaptable for clamshell or dragline buckets.

There are three major parts for the attachment. A 19-foot boom, a dipper arm, and an auxiliary A-frame member which is designed to take the strains and stresses of trench hoe operation. The attachment is adaptable to any Universal crane with double drum separately driven. It is readily and quickly transferable with the standard crane boom for use with clamshell or dragline bucket, hook block, backfiller board, etc.

The working radius of the attachment is a maximum reach of 26 feet and a digging depth of approximately 13 feet when the crane is mounted on a standard 5-ton motor truck. As an exclusive feature, the attachment has an automatic tilt bucket for dumping materials direct into trucks. This 5%-yard bucket is hinged at the front end and arranged to pivot about this point for spilling Material is taken in and dropped through the front open end of the bucket. The tilt bucket is power operated by the use of the standard boom hoist attachment which pulls up on a rigid stiff arm at the back of the bucket. The stiff arm is equipped with a safety lock which prestill arm is equipped with a silvent also universal crane with new trench bucket tilting until desired. This also universal crane with new trench bucket tilting until desired. This also universal crane with new trench bucket tilting until desired. This also universal crane with new trench bucket tilting until desired. locks the bucket rigidly in place for use in dumping on a spoil bank well above the machine on either side.



# BULL FROG WHEELBARROWS

## CUTTING THE COST OF MATERIAL HANDLING

Every number in the long list of Bull Frog barrows, carts and scrapers for contractors' use is specially designed and built to reduce the cost of material handling. Examine the specifications of any Bull Frog product and you will find many exclusive features, such as the smooth-running, Never-Break wheel, the nicely balanced load, and the specially designed seamless tray which gives strength, long life and ease of handling.

THE TOLEDO WHEELBARROW CO.
Toledo, Ohio

Branch Offices and Warehouses

Philadelphia 233 North 12th St. Chicago

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Built for Work



When writing to advertisers, please mention the Contractors' & Engineers' Monthly-Thank you.

## A Compact Power-Shovel with Revolving Deck

Built for Operation as Grading Shovel, Backfiller, and Crane

POWER-SHOVEL which weighs only 17 tons and yet which has full swing, a telescoping handle, a 19-foot reach and which can climb a 35 per cent grade, has been developed by the Star Drilling Machine Company, Akron, Ohio. The Star power-shovel, which is full-revolving, has the revolving deck secured to the main frame by a center pin as well as by a set of powerful jibs contacting with the outer edge of the swing roller The load is carried opposite the main weight of the machinery-never at right angles to it. The shovel uses either gas or electricity for

The crawler tread of the Star power-shovel gives 4,480 square inches of bearing surface with a total weight of 71/2 pounds per square inch. All levers and parts of the shovel are easily handled radius. The shovel has an 11-foot crowd and a floor digging radius of 21 feet. Hence, it can completely grade a street 42 feet wide from curb to With skimmer attachment, the shovel can clear a truck 19 feet above. While the bucket is rated at 3/4-yard, the grading shovel has shown that it can handle a full yard in clay and dirt for-

Operating as a ditcher, the McCourt Construction Company, Akron, Ohio, on several days opened 600 feet of trench 7 to 9 feet deep and laid the tile. One morning, in 31/2 hours, 300 feet of trench 71/2 feet deep was opened and finished with 24-inch sewer pipe. The average gasoline consumption was 25 gallons per day.

The Star power-shovel may also be used for backfilling. The backfiller can be put on or taken



STAR POWER-SHOVEL GRADING EQUIP-MENT HANDLING A UNIQUE PIECE OF EXCAVATION

and serviced. The traction lock, swing lock, main clutch lever, crowding and hoisting levers and electrical starting button are conveniently located. The operator trips the bucket, starts the engine, locks his tread wheels, and completely handles his machine without leaving his seat. The shovel is so built that it can be readily transported by trailers, cars or boat. As optional equipment, a mechanical trip driven by the power of the engine is offered for this shovel. The control is placed at the operator's seat and is manipulated by his foot. The shovel is powered with a four-cylinder Waukesha Ricardo head motor of the GU type with a 60horsepower rating.

Because of its "turtle-head" telescoping handle.

the machine can swing completely in an 11-foot

off in 15 minutes. Being 5 feet wide and 21/2 feet high, it scoops from one to two yards at a stroke. The manufacturers state that the backfiller has been known to fill a thousand feet of water-line ditch in five hours. The backfiller reaches out 31 feet from the center pin and makes from three to five strokes of 16 to 18 feet per minute.

Operating as a crane, it can be used with a 1/2yard digging bucket or a 3/4-yard material bucket. It may be equipped with a 19-foot crane boom for clamshell work with a 1/2-yard bucket. With this boom it clears the ground from 10 to 12 feet at a radius swing of from 16 to 18 feet. With a 30-foot crane boom the 1/2-yard clamshell bucket swings clear 19 to 20 feet at a 20-foot-swing radius. The carrying capacity is 5,000 pounds.



THE HELTZEL STEEL FORM & IRON COMPANY, Warren, Ohio

### A New Model Portable Asphalt Repair Plant

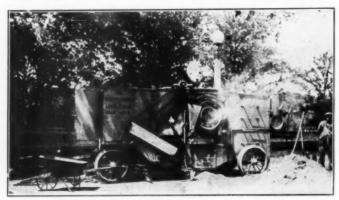
Unit Completely Equipped with Rotary Sand Drier, Pug Mill Mixer, Oil Burners and Measuring Devices

A COMPLETE portable asphalt repair plant, which is readily transportable and capable of economically producing material for street repairing with mixtures equivalent to those delivered from large stationary plants, has been announced by the Chausse Oil Burner Company, West Beardsley Avenue, Elkhart, Ind. This plant produces and permits the laying of genuine hot asphalt and can handle the entire patching of medium-size and small cities, localized patching work for large cities or for supplementing stationary plants, or winter patching when large plants cannot be run economically. They are also effective units for contractors handling small asphalt paving jobs in private work.

Model E-3 plant is equipped with a Continental Red Seal four-cylinder engine which drives the rotary sand drier, pug mill mixer, and which furnishes propulsion through a hardened-roller heavyduty chain, temper rim sprockets and individual clutches.

The plant is rated at 150 square yards of 2-inch compacted mix per 8-hour day, but it can operate economically on a smaller output or produce a considerably increased amount without harm to the mechanism. It is stated that the machine will produce a 450-pound batch, sufficient to cover 2½ square yards of 2-inch compacted asphalt every five or six minutes.

Reclaiming old asphalt during the operation of



CHAUSE
COMPLETE
PORTABLE ASPHALT
PLANT IN USE BY
THE COMMISSIONERS
OF LINCOLN PARK,
CHICAGO

The new Model E-3 Chausse plant is a mechanically operated machine with rotary sand drier, pug mill mixer, oil burners and measuring devices, all of which are found in stationary plants. In addition, it is self-propelled on rubber-tired wheels and contains storage bins for materials, making the machine an independent unit for use directly where the work is being done.

The machine will keep five men busy raking and laying, according to the manufacturers, who also state that the operating cost is far lower than any other means of mixing asphalt in small quantities, requiring only two men, four gallons of kerosene per hour and ten gallons of gasoline per day. The

the machine is a valuable feature if desired. The material can be cut from the street, loaded into the sand drier, heated to 350 degrees, agitated in the mixer, new asphalt added and returned to the street, thus providing a marked economy in patching costs. A tool heater with oil burner is located at the rear of the machine for heating rakes, tampers, shovels and smoothing irons.

In the machine is bin storage for 135 gallons of asphalt, 2½ yards of mineral aggregate, 18 bags or 1,750 pounds of lime dust or cement, and tanks to hold 60 gallons of kerosene and 9 gallons of gasoline. The weight of the machine with tanks and bins empty is 9,400 pounds.

### The Statistician Cuts Loose Again

A CCORDING to a statistical genius of the Ingersoll-Rand Company, 31,000,000,000 cubic feet of earth and rock, enough to have reduced the surface over the entire 22-square-mile area of Manhattan Island by 50 feet or to have put Manhattan below sea level from the Battery north to Columbus Circle, has been cut, blasted and

drilled from the island since excavation first began for building subways and public service conduits. Excavation operations will entail this year an expenditure of \$150,000,000, or more than six million times as much as Peter Minuit paid the Indians for the whole island of Manhattan three hundred years ago.

### SELEY for Shovel - Ditcher - Crane Skimmer and Dragline Work EXCAVATOR

Estreme Right— Inster Dirches owned by Pittman Construction Co., Adel, Ga.

Right—INSLEY CRANE owned by Green-Boots Construction Co., Oklahoma City.

Below-INSLEY CRANE owned by Ferro-Concrete Construction Co., Cincinnati.



# TRENCHING

OU can do deep trenching with an Insley Ditcher or an Insley Crane. Either way you win. The

Ditcher will dig a clean straight ditch in any soil that is hard enough to stand up without shoring, and the Crane, because of its sensitiveness and ease of control, is ideal for working around trench bracing. Furthermore the Insley Crane will boom up and down under load a unique feature of a machine of this class.

Whether your work is sewer trenching, drainage ditching, road grading, basement work, or any one or all of a dozen different types, the Insley Excavator will handle it to your advantage. Write for Catalog 51.



SKIMMER



DRAGLINE



SHOVEL

NSLEY MANUFACTURING COMPANY - Indianapolis

**ENGINEERS** AND MANUFACTURERS

### A New Combined Portable Air-Compressor and Water-Pump Outfit

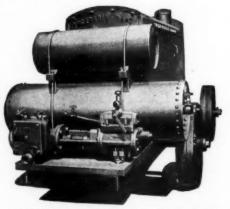
Two Essential Pieces of Contractors' Equipment United on One Frame

A COMBINED portable air-compressor and water-pump outfit, consisting of a standard Type-20 gasoline-engine-driven portable compressor and a Cameron air-driven pump, has been announced by the Ingersoil-Rand Company, 11 Broadway, New York. This outfit is particularly suitable for dewatering jobs and can be used successfully for the elevation of water, for removing the over-night accumulation in ditches and excavations, for cement gun service, and for furnishing water to concrete mixers, etc. The portable compressor, in addition to supplying air for the pump, will run "Jackhamers," rock drills, paving brea'cers, clay diggers, portable hoists, and drill-steel sharpeners.

The pump is mounted on the frame of the compressor adjacent to its source of power. It is positive in action, starting up just as soon as the air is turned on. It requires no priming and will handle muddy water. It can also be regulated to any desired capacity within its maximum rating by adjusting the amount of air admitted.

Practically all of the pumping equipment in use by contractors today consists of a pump and some form of independent prime mover, usually a singlecylinder gas or oil engine. This means two pieces of machinery which must be moved and set up each time the pump is needed. It also means two separate pieces of equipment which must be kept in perfect condition, so that the pump will be ready to go to work whenever it is required.

Most jobs now require compressed air, and a compressor is therefore generally available. The



INGERSOLL-RAND PORTABLE AIR-COMPRESSOR WITH PUMP ATTACHED

advantage of having an air-driven pump mounted right on the compressor eliminates the gas or oil engine which was formerly used to drive the pump. With this new outfit the pump is ready for work whenever the compressor starts up. The unit can be moved easily from place to place as occasion requires. Several sizes of these compressor-pump outfits are available. It is also possible to obtain the pump alone, together with all parts necessary for attaching it to any Ingersoll-Rand portable now in the field.

### New Arc-Welding Machine Made of Welded Steel

Electric Welding Carried to a Logical Conclusion



THE LINCOLN PORTABLE ARC-WELDER

MONG the many interesting developments in the machinery building field is the substitution of welded structural steel in place of gray iron castings. The 1927, 300-ampere alternating current power-supply Lincoln "Stable-Arc" welder illustrated shows the welded steel idea carried out to its logical conclusion. There are only two gray iron castings, weighing a total of about 15 pounds, on the outfit which have not been replaced with welded steel construction. motor and generator end-rings, brackets and connecting ring are all made of structural angles rolled up into the proper shape and welded together. The feet of the motor generator set are made of drop forgings. The truck wheels are made of T-sections rolled on a special machine. The hub of the wheel is made of steel tube. Control panels are usually made of slate or special non-metallic compounds, but the panel illustrated

# Sensational New Features of the No.31/2 Kwik-Mix Trailer

You can tilt the drum at any angle, lock it and hold it in any position as easily as you can steer an automobile.

That's one new and exclusive improvement of the 1927 model of the No. 3½ Kwik-Mix Trailer.

Many new advantages make it

### Faster, Handier than Other Mixers

"Greatest improvement I ever saw on a mixer." "Wouldn't go back to the old kind on a bet." So say contractors who have seen the new No. 31/2.

It has emphatically the best-balanced drum of any tilting type mixer, and greater capacity than the average 3½-ft. mixer.

Besides, all the sturdy characteristics of the famous KWIK-MIX line are included in this mixer such as: spring-mounted axles with roller-bearing cushion-tired disc wheels and quick-detachable drawing bar.

The No. 3½'s unusual speed, ease of operation and perfect-mixing capacity place it in a class by itself.

We stake the Kwik-Mix reputation of many years' standing on the merits of this new Trailer.



### Contractors, Get This Remarkable Catalog

Explains fully the interesting, exclusive improvements of this wonderful mixer. Gives prices, details and pictures of the biggest and most diversified line of first-class Concrete Mixers and accessories ever put out by the pioneer mixer makers. No contractor can afford to pass this by. Write TODAY.

KWIK-MIX Concrete Mixer Co.

Most Complete Catalog of Late Model Late Oriced	Kwik-Mix Concrete Mixer Co. Dept. 10 Port Washington, Wis. Please send me catalog and terms on the Kwik-Mix line.
LOWFERS	Name
Minished	City State
Everpubli	Street

is made of sheet steel welded together and welded

to the supports.

The underlying idea in the application of the principles of welded steel construction to the Lincoln "Stable-Arc" welder, made by the Lincoln Electric Company, P. O. Box 683, Cleveland, Ohio, was to meet the severe conditions to which portable welding equipment is subjected. Failure in operation of a welding machine is, in many cases, a serious matter. It is claimed that the steel con-

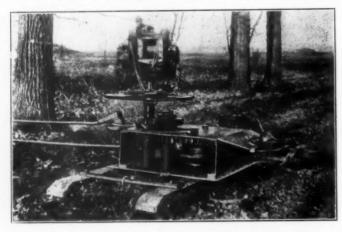
struction, owing to the fact that it will bend rather than break, reduces the liability of failure, for the reason that the bent parts may be straightened and the equipment put in operation without waiting for replacement castings. In several cases, the control panel has been crushed, with instruments and switches wrecked. However, the equipment was repaired by straightening the panel and switches and put into operation within an hour without the instruments.

### A Land-Clearing Machine for Endless-Cable Operation

Used with Light- and Medium-Weight Tractors

A PRACTICAL stump and tree puller which possesses both speed and power has been developed for use with light- and medium-weight tractors by the John Waldron Corporation, New Brunswick, N. J. This Handy-Andy-Senior land-clearing machine served by three men and a tractor can pull from 50 to 200 stumps per day, the daily capacity depending, of course, on

the tractor and can be unhooked from it in a minute by simply throwing the drive cable off the winch. The Fordson, Cletrac Model-K, or McCormack-Deering 10-20 or 15-30 tractor can then be used for any other service necessary. The stump puller is driven by the tractor in a manner similar to the driving of a saw, except that a cable is used in place of a belt.



HANDY-ANDY-SENIOR STUMP FULLER IN AC-TION, SHOWING OPERATING TRACTOR WITH BOPE DRIVE TO STUMP FULLER IN BACKGROUND

the kind and size of trees or stumps and the kind of soil they grow in.

To save cable breakage this machine should be used with one block, giving it a pulling capacity of 100,000 pounds. This arrangement is practical for handling stumps or trees ranging in size from 10 inches to 30 inches in diameter. By using two blocks, almost any size stump can be pulled. The puller itself is made of high-grade steel throughout and is fitted with bronze bearings.

The Handy-Andy-Senior is a separate unit from

The Handy-Andy Senior consists of an anchor cable which runs to an anchor stump or tree and back to the puller; a drum or pull-line cable which runs directly off the drum to the stump when a block is not used; a drive cable which runs around the drive wheels and to the tractor, this cable usually being wrapped twice around the winch on the tractor and is of 3%-inch extra-soft cast steel, endless, and 35 feet long; and a load-release lever for relieving the load on the drum when unwinding the drum cable.

### New Monarch Distributors

THE Monarch Tractors Corp., Springfield, Ill., has announced the appointment of the Weber Implement and Automobile Co., St. Louis, Mo., as distributor for Monarch tractors for southern Illinois and eastern Missouri; and the

Kansas City branch of this company as distributor for western Missouri and eastern and southern Kansas. The appointment is also announced of E. F. Craven Co., Greensboro, N. C., as distributor in the state of North Carolina.

# The ERIE Aggre Meter is Self-Cleaning



### A New Expansion Joint with Fibre-Board Base

Waterproofed Fibre Board Impregnated with Asphalt Offers Serviceable Material

THE Servicised Products Company, 6051 West 65th Street, Chicago, Ill., has developed a new expansion joint for concrete road construction which it is marketing under the name "Servitex." The joint is made of Celotex impregnated with asphalt as described below.

Celotex is a matted fibre board composed of bagasse fibre and is made by the Celotex Company, 645 North Michigan Avenue, Chicago, Ill. Before the fibre is matted, it is treated to remove all materials soluble in water which contain food for decaying bacteria. This leaves practically a pure cellulose which remains unchanged after successive moistening and drying and, unless conditions are extreme, deterioration is extremely slight. The fibre is, however, thoroughly protected by the colloidal action of a prepared compound and actual wetting of the surface is very difficult to accomplish.

The process of matting produces a material which has two important properties: rigidity and porosity. Celotex may be cut and handled similarly to lumber, and normal temperature changes have offect on its strength. By special processing the material can be shaped and relatively sharp bends can be made without great difficulty. The shaped material is equally as rigid as the sheet material and responds to further treatment in the same manner.

Porosity is desirable from the standpoint of light weight and compressibility. Celotex requires only a moderate pressure to reduce the thickness to 50 per cent of the original value and the re-expansion is comparatively high. The fibres are sufficiently flexible to prevent their being broken on compression and because of the numerous air spaces they remain almost intact when pressure is applied.



SERVITEX CENTER STRIP



SERVITEX EXPANSION JOINT

When Celotex is heated and immersed in a hot asphalt saturant, it absorbs as much as double its own weight of the bitumen without filling the air cells to any great extent. The surface of the fibre becomes coated with a thin film of material and in many cases the individual strands become filled through capillary action. This is the first step in the use of Celotex to make the Servite expansion joint which has been placed on the market by the Servicised Products Company, 6051 West 65th Street, Chicago, Ill. In this form the fibre is waterproofed, but the surface of the mat is dry and non-adhesive. For further protection and to produce a surface which will adhere to the concrete, the saturated Celotex is dipped into a high-melting-point asphalt and completely jacketed. The coating asphalt is adhesive and non-brittle, but when slightly dusted does not cause the pieces to stick together during shipment.

This doubly waterproofed Celotex constitutes Servitex expansion joint. Recent experiments conducted in the Servicised Laboratories demonstrated that after being compressed to 1/4-inch. a 1/2-inch piece of Celotex reexpanded slowly to 0.45 inches. This represents a permanent set of only 10 per cent of the total thickness of the piece and a recovery of 80 per cent of the total distance compressed. Similar tests on saturated pieces of Celotex showed that the amount of reexpansion was unaffected by the presence of the saturant, but the pressure required for a given reduction in thickness was somewhat greater. Reexpansion in the case of the saturated material was somewhat retarded, but that is of little consequence since concrete moves slowly.

Modern traffic has become so heavy that mest

### A New Culvert in 8 hours



### "they simply jacked an ARMCO through"

A NEW culvert was needed as an outlet for a summer resort lake in Ohio. An old timber arch 30 feet under a county highway had failed. The new culvert—180 feet of 15-inch Armco Pipe—was in place within 8 hours. A foreman and five men did the work, a sandbag dam holding the water back until the job was done. And the cost of the installation was one-fourth the estimated cost by the open-trench method.

This satisfactory result has been duplicated in many other cases—by railway and highway officials. The jacking method not only greatly reduces the cost, but is quickly carried out. There is no traffic interference. And the roadbed is left intact—no backfilling, no settlement.

The easy, economical jacking method is applicable also to the placing of culvert pipe under roadways to give additional drainage, or to provide for gas and water mains, electric power-line conduits or for any other purpose when an opening must be provided through an existing embankment.

Let Armco engineers help you plan your culvert jacking jobs.

Armco Culvert Mfrs. Association MIDDLETOWN, OHIO

### **ARMCO CULVERTS**

Consistent performance—because of consistent uniformity

city pavements employing sheet asphalt, brick, granite block or wood block wearing surfaces require a concrete base. The conditions to which such a base is subjected are almost as severe as a one-course concrete pavement and expansion and contraction take place with equal intensity. Fractures which result when no regular joints are provided are transmitted through the wearing course and disintegration commences. A disintegration of the wearing course causes considerable impact to be thrust against the base when heavy trucks

move over the point of fracture. The result is a gradual destruction of the pavement.

An ordinary type of asphalt expansion joint is inapplicable since oozing will cause an upheaval of the wearing surface, thereby forming a ridge, which is undesirable. The solid asphalt fibre material shows no appreciable reexpansion; and since the joints are inaccessible, the space left by a contracted slab cannot be poured. Servitex is said to eliminate these objections and along with them the objections to expansion joints in concrete bases.

## 1-1/4-Yard Power-Shovel Stepped Down to 1-Yard Capacity

New Development in Power-Shovel Practice

A NEW precedent in the development of a power shovel, the Lorain-60 one-yard shovel, crane and dragline, has been announced by the Thew Shovel Company, Lorain, Ohio. In the past, when changing conditions made a larger capacity machine necessary for standard use, it has been common custom to step the old standard machines up to the required larger capacities. This meant strengthening the parts throughout to meet the increased working radius.

The Lorain-60, however, is the Lorain-75, a 11/4-yard machine stepped down to 1-yard capacity. It

is the Lorain-75 in everything but dipper capacity, power-plant, power take-off and counterweight, in that it retains all of the strength of the larger machine, and has the same interchangeability of booms for shovel, crane or dragline. It will handle a crane boom up to 50 feet in length and can be counterweighted for unusual stability.

When the owner of one of these smaller machines has developed the need for a larger capacity machine, all he has to do is to substitute a Lorain-75 power-plant and accessories and he has a full 1½-y-ard machine in every respect.



ONE OF THE NEW LOBAIN-60 SHOVELS LOADING A MOTOR TRUCK ON A RAMP

There were more
BEAR CATS
built and sold
during 1926 than
ALL the other
½-yard machines
put together

THE BYERS MACHINE CO., Ravenna, Ohio

BYERS BEAR CAT

### Gasoline Locomotives of from 4 to 20 Tons

All Sizes Geared for Four Speeds Forward and Four Speeds Reverse

THE well-known line of Type-H Milwaukee gasoline locomotives, made by the Milwaukee Locomotive Manufacturing Company, Milwaukee, Wis., is built in 4-, 6-, 7-, 8-, 10-, 12-, 16-11 20-ton sizes; all sizes, except the 20-ton locomotives, are of the same general construction. The H-20 differs somewhat in the design of the frame and spring suspension. The 4-, 6-, and 7-ton locomotives are designed to operate at speeds of 2, 4, 6, and 12 miles per hour, whereas the 8-, 10-, 12-, 16- and 20-ton locomotives operate at speeds of

2, 4, 8 and 12 miles per hour.

All Type-H locomotives are designed for various gages of track. The 4-, 6-, 7- and 8-ton units are for gages of from 18 to 561/2 inches, the 10and 12-ton from 24 to 561/2 inches, and the 16and 20-ton from 30 to 561/2 inches. All these locomotives up to and including the 16-ton size have inside wheels and gear and chain drive. The 20-ton locomotive has gear, chain, and side-rod drive. Those of 561/2-inch gage have outside wheels, whereas those for gages of less than 561/2 inches have inside wheels. The frames for all sizes up to 12 tons have heavy semi-steel side-frames with reinforced channel iron end-sills. The 16-ton size has cast steel side-frames and reinforced channel iron end-sills, and the 20-ton locomotive has cast steel side-frames with cast steel end-sills. The end-sills are bolted to the side-frames by means of extra-heavy double-corner brackets or bumper knees both inside and outside.

In locomotives equipped with link-and-pin couplers, the reinforced channel iron end-sills of the locomotive frame serve as bumpers on which the draw-castings are mounted by means of massive through-bolts. The standard-gage locomotives, with the exception of the 20 ton model, are equipped with M.C.B. couplers and have combination bumpers and draw-castings. In the 20-ton model the massive cast steel end-sills also serve as the bumpers.

Ail the locomotives, except the 20-ton model, have a long oil-tempered coil spring of large diameter over each journal box. Great care has been exercised in selecting springs of the correct size and resiliency to not only carry the weight of the locomotive and insure easy riding, but to enable the locomotive to hold the rails when riding

over poor tracks.

All Milwaukee locomotives, except the 20-ton model, are furnished with rolled steel wheels with either standard or M.C.B. flange. The 20-ton model of 56½-inch gage is equipped with steel-tired wheels with M.C.B. flange, whereas those locomotives of less than 56½-inch gage have rolled steel wheels.

As the cars hauled by an industrial locomotive are, as a rule, not provided with brakes, it is of the utmost importance that the brakes of the locomotive be of high efficiency, smooth in action and easily adjusted and maintained. The brakes of the 4-, 6-, 7-, 8- and 10-ton models of all gages,

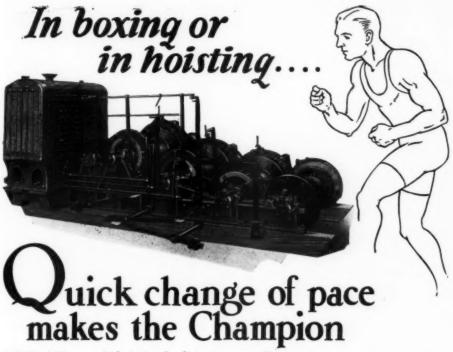
as well as the 12-ton models of less than 30-inch gage, are all of the drum type, operated by a hand lever with steel brake drum mounted on the drive-shaft of the transmission. The 12-ton models of 30- to 56½-inch gage, as well as the 16- and 20-ton models of all gages, are equipped with conventional hand-operated four-wheel brakes of the spread type with removable shoes.

The sand box is of large capacity and is mounted under the hood where the heat from the engine keeps the sand dry. The sand box is at a sufficient height to give a steep pitch to the sander pipes, thereby insuring a ready flow of

The engines of the various sizes are of the heavy-duty type and of ample size and horsepower to give the locomotive the drawbar pull necessary. The 4-ton model is equipped with a Hercules Model-OX 4 x 5-inch 4-cylinder engine developing 40 horsepower at 1,400 r.p.m. The 6-ton and 7-ton models are equipped with Beaver Model-JE heavy-duty, 434 x 6-inch, 4-



FOUR-TON 36-INCH-GAGE MILWAUKEE GASOLINE LOCOMO-TIVE WITH LINK AND PIN COUPLERS



THE ability to shift instantly from "top speed" to "slower going" . . . quick-as-a-wink adaptability to changing conditions . . . that's what made Benny Leonard the master of all comers . . . and it's what makes the new Mundy the champion of all hoists.

The new Patent Three-Speed Mundy Hoist has administered a speedy knock-out to the old con-With quick change of pace . . . line pull in ten seconds flat . . . it has established new records and saved dollars and hours

The sliding gear transmission different line pulls and speed raception of hoisting schedules. tios . . . it means real speed on average loads with a lightning complete change of speed and change to intermediate or low New Bulletins are waiting for

you! The Mundy Sales Corporation

Distributors for the J. S. Mundy Hoisting Engine Co. 30 Church St., New York

affords instant command of three speed when the going is heavier.

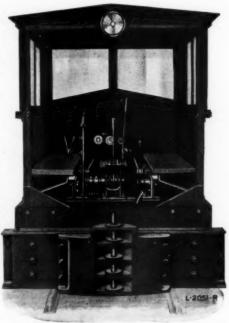
To Equipment Distributors

For the entire Mundy line of hoisting equipment, some exclusive sales territory is still open.

# HOISTS

cylinder engines developing 50 horsepower at 1,000 r.p.m. The 8-ton model is equipped with a Climax Model-TU heavy-duty, 51/2 x 7-inch, 4-cylinder, engine developing 67-horsepower at 1,000 r.p.m. The 10-ton model is equipped with a Beaver Model-JD heavy-duty, 43/4 x 6-inch, 6-cylinder engine, developing 75 horsepower at 1,000 r.p.m. The 12-ton model is equipped with a Climax Model-RBU heavyduty, 51/2 x 7-inch, 6-cylinder engine, developing 104 horsepower at 1,000 r.p m. The 16-ton model is equipped with a Beaver Model-RD heavy-duty, 534 x 7-inch, 6-cylinder engine, developing 115 horsepower at 1,000 r.p.m. The 20-ton model is equipped with a Beaver Model-RY heavy-duty, 61/2 x 7-inch, 6-cylinder engine, developing 160 horsepower at 1,000 r.p.m.

The large, roomy cab of the 4- to 16-ton locomotives is of all-steel construction with the window over the hood, sliding side windows and a weatherproof rear curtain, giving the operator a clear view in all directions. The steel cab of the 20-ton model has three front windows, sliding side windows and sliding rear doors. The operator's seat is on the left side of the cab, the operator sitting crosswise in the locomotive when in driving position, which experience has shown to be the most convenient driving position for general operating conditions. The cab is so designed that when the locomotive is to be operated where the overhead clearance is limited, the entire upper portion of the cab, including the windows, may readily be detached by merely removing a few bolts.



CAB-END VIEW OF THE 4-TON GASOLINE LOCOMOTIVE SHOWN ON PAGE 118

### One-Man Steel Dump-Trailer

All-Steel Equipment with Wide Wheels Built Especially for Tractor Operation

A N all-steel dump-trailer designed for use in serving steam shovels and elevating graders has been developed by the Euclid Crane & Hoist Company, Euclid, Ohio. These dump-trailers are designed for use with crawler-type tractors, and being equipped with wide wheels are capable of working under conditions where other equipment would mire. They can also be equipped with rubber-tired wheels so that they may be used at high speed on hard roads.

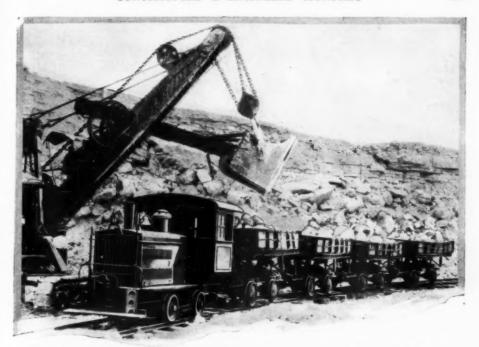
The standard steel wheels are 46 inches in

EUCLID TRAILER AND 2-TON CRAWLER TRAC-TOR UNDER HARD GOING CONDITIONS

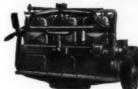
diameter with a 10-inch face, and are mounted on Hyatt roller bearings and heat-treated steel axles. These large wheels and roller bearings make the trailer light in draft. Under normal conditions a 2-ton tractor will handle a fully loaded trailer very nicely, although in some extremely bad cases a 5-ton tractor may be required.

The body is of the standard rectangular box type with an automatic end gate which swings back as the body dumps to the rear. When the body is in an extreme dumping position the bottom is standing at right angles to the ground, thus leaving no obstruction for materials while they are being discharged. Being of the rear-dump type these trailers unload in mud conditions where a drop-bottom dump-trailer might find difficulty. The standard capacity of the body is 2 yards, which is easily increased to 23/4 yards by the use of steel side extensions, easily bolted in place. The trailer is, of course, designed to take care of the additional load imposed by the use of the extensions.

The normal height of the two-yard body is 60 inches from the ground. The length of the trailer from the tip of the drawbar to the rear is 11 feet and the width over wheels is 7 feet. The weight is 2,800 pounds.



### Ideal Hauling Unit"-



Leading Manufacturers Using Timax as Standard Equipmen

stin Machine Co., Muskegon, Mich. City Dredge Works, Bay City, Mich. wn finisting Machinery Co., 4403 St. Ci

in Foundry & Machine Co., Madi-

**Equipped** with the Ideal Power

The National Mortar & Supply Co., of Gibsonburg, Ohio, who are using six Plymouth Gasoline Locomotives, made by The Fate-Root-Heath Company, of Plymouth, Ohio, write:

"We have found the Plymouth Locomotives very economical when compared with the one steam locomotive which we are running, and much more convenient and flexible, as it does away with the haulage of coal and water and the trouble incident to the use of water in winter. They are ready for service at any instant, and when not in service, there is no labor or expense connected with them. We consider the Plymouth the ideal haulage unit for our purposes."

Note the advantages mentioned: economical-convenientflexible—nowater or fuel bothers—always ready—no expense when not in service, because Plymouth Locomotives are equipped with—



"The Trustworthy Engine" Write for Bulletin E

### CLIMAX ENGINEERING CO. 1 W. 18th Avenue Clinton, Iowa

Eastern Branch:
30 E. 42nd St., New York, N. Y.
Cleveland Branch:
657 Leader Bildg., Cleveland, Ohio
Chicago Branch:
2007 Harris Trust Bildg., Chicago, Ill.
Los Angeles, Calif...
Coast Machinery Corp., 464-66 E. 3rd St.

San Francisco, Calif.: Coast Machinery Corp., 829 Folson St. Portland, Ore.:

J. L. Latture Equipment Co., 354 Belmont St. Montreal, Que., Canada: Edward C. Dingman, 1005 Reefer Bldg.



# Put These Catalogs to Work

THE catalogs and pamavailable for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

### ROAD MACHINERY THAT MAKES EVERY JOB PROFITABLE

FROTITABLE
Every job and every part of it should show a profit.
If you use Acme-built equipment, described in the
Acme catalog and Bulletin 125, issued by the Acme
Road Machinery Co., Frankfort, N. Y., you will be
taking advantage of the experience of many contractors
who have made their profits by using this equipment.
A TRACTOR THAT SATISFIES
LT tractors is the Sector with profice that

J-T tractors in the five-ton size, with engines develop 40 horsepower, furnish satisfaction on ejob. Complete information and catalogs may be cured from the J-T Tractor Co., Cleveland, Ohio. with engines that

WOODWORKER FOR CONTRACTORS

The Detroit woodworker, a complete woodworking alop of 12 machines in one, which makes every cat necessary in any form of construction, is described in the catalog of the Master Woodworker Mfg. Co., 610 Brush St., Detroit, Mich.

A TWIN BACKFILLER
The Waterman Twin Backfiller, which backfills
shoulders and cleans ditches and excavates, mounted
on a Fordson, is described completely in the catalog
of the Waterman Corp., 687 East Fort St., Detroit, Mich.

A BULLETIN DEVOTED TO PORTABLE

A BULLETIN DEVOTED TO PORTABLE CONVEYORS

Bulletin No. 55 which has recently been issued by the Fairfield Engineering Co.. Marion, Ohio, describes the complete line of Fairfield portable conveyors including scraper-conveyors, belt-conveyors, track-feeders, discusses methods of feeding conveyors, gravity feeding pits, and gives general dimensions and specifications of the Fairfield line.

IMPROVED CILING SYSTEM GIVES LONGER LIFE TO PAVER

A NEW MODEL 3-TON CHASSIS

The Indiana Truck Corp., Marion, Ind., has recently developed a new Model-126 3-ton chassis with two-range transmission and other features making it a truck worth the attention of the contractor. The complete description will be furnished on request.

A NEW SINGLE-UNIT MECHANICAL CHIP-SPREADER

The Good Roads Co., Inc., Upper Darby P. O., Phila-delphia, Pa., will be pleased to send a copy of its illus-trated folder completely describing the Goroco mechani-cal chip apreader, which quickly attaches to the back of any motor truck.

POWER FOR SAND PUMPS AND CRUSHERS
Bulletin K, recently issued by the Climax Engineering Co., I West 18th Ave, Clinton, Iowa, describes
Climax Trustworthy Engines, especially in service for
the operation of sand pumps and crushers. Bulletin O
describes the service of these engines for saw-mills.

deacrines the service of tease engines for saw-mins.

A COMPLETE LIST OF SALES AGENTS
The Chain-Belt Co., 766 Park St., Milwaukee, Wis.,
manufacturers of Rex chains, Rex concrete mixers, Rex
traveling water-screens, elevators, and conveyors has issued a handy booklet of 28 pages entitled "The Rex
Family." In which are listed the names of all the members of the home office organisation, affiliated companies, district offices, distributors and jobbers.

COMPLETE EQUIPMENT FOR CONSTRUCTION WORK

WORK
The latest catalog of the Union Iron Works, West
Shore Siding, Hoboken, N. J., lists the complete line of
Union equipment for construction work, including
Unionlock concrete buckets, Union grout mixers and
ejectors, cableway skips, tunnel shields, air locks, etc.

A NEW CRAWLER SHOVEL

The new Link-Belt K-42 crawler shovel, which has
greater capacity, more speed and greater endurance
and which is claimed to be "the best that money can
buy," is described completely in the literature which
may be secured from the Link-Belt Co., 300 West
Pershing Rd., Chicago, Ill.

A ONE-MAN GRADER THAT ECONOMIZES ON EVERY GRADING JOB

EVERY GRADING JOB
Every contractor is interested in cutting his grader
gang down to one man, and the Hadfield-Penfield Steel
Co., Bucyrus, Ohio, in its free literature tells how the
Hadfield-Penfield one-man grader, equipped with dual
rubber wheels or with the H-P rigid-rail track or full
crawlers, will do the trick for you.

TRUCKS THAT PREDOMINATE IN HEAVY HAULING

Mack trucks, which have a strangle hold on hauling costs and which always predominate where the going is hard, are completely described, with helpful data and suggestions for the benefit of contractors, in the latest literature of Mack Trucks, Inc., 25 Broadway, New York.

A HORIZONTAL TYPE SLOW-SPEED POETABLE
AIR-COMPRESSOR
The trailer horizontal type slow-speed double-acting
portable air-compressor with worm drive, which offers
particular advantages in the way of large capacity,
high efficiency, freedom from vibration and long life,
is described in the literature of the Cement Gun Co.,
Inc., Allentown, Pa.

A LEANING-WHEEL GRADER EASIER TO OPERATE
The new Galion leaning-wheel grader with the E-Z
lift, which is stronger and more durable, with 8, 9,
10 and 12-foot moldboard sizes, as well as the complete line of Galion road machinery, is described in
the latest literature of the Galion Iron Works & Mfg.
C. Galion Oblic. Co., Galion, Ohio.

ELECTRIC OR GAS HOISTS FOR ALL LOADS
Bulletins 80-E and 80-S issued by English Bros. Machinery Co., Iron Works Dept., Kansas City, Mo., describe Samson hoists which are electric or gasoline-engine powered for loads ranging from 500 to 8,000 pounds.

A TURBINE CONCRETE SURFACER
The No. 5 turbine concrete surfacer, a light, portable
machine which will work on either green or hard concrete, is described in a folder which may be secured
from Wm. E. Tousley, Tousley Tool Co., 1965 East 66th
St., Cleveland, Ohio.

St., Cleveland, Onlo.

EQUIPMENT FOR CONTRACTORS' FORDSONS

Whitehead & Kales Co., Detroit, Mich., has issued a well-lilustrated descriptive catalog covering the entire line of W & K equipment for Fordsons which is of interest to contractors, including cushion-tired wheels, extension weights, pneumatic-tired wheels, extension rims, automatic coupler hitches, bumpers, one-ton eranes, shop trailers, one-cubic-yard trailer-uniteristics, trailer chassis, three-cubic-yard trailers, automatic brake assembly, snow and street sweepers, sprinkler tanks, street flushers, golf course wheels, etc.

# Mow 360160 H.P.

From the Small 3 to the Big 160 H.P. There is a LeRoi or Beaver Engine to Serve You LeRoi

MILWALIKEE



EROI PIGINES

A TRACTOR-OPERATED LAND-CLEARING MACHINE A THACTOR-OFFRATED LAND-GLEARING MACHINE
The Handy-Andy Senior, which is a stump machine
operated by a Fordson, Ciletrac Model K, or McCormickDeering 10-20 or 15-30 tractor, and with which three
men can pull from 50 to 200 stumps per day, is completely described in an illustrated folder which may be
secured from W. G. Carter, Sales Manager, Puller Division, John Waldron Corp., New Brunswick, N. J.
TACKLE BLOCKS FOR MANILLA OR WIRE BOFE
Anvil brand blocks for maille or wire rope made in

Anvil brand blocks for manification of wire Rope Anvil brand blocks for manific or wire rope made in all standard styles and sizes are described in Catalog CE which may be secured from the Western Block Co., Lockport, M. Y.

GASOLINE LOCOMOTIVES FOR CONTRACTING

SERVICE

SERVICE

Witcomb gasoline locomotives, which have the maximum drawbar pull per ton of weight and are made of any gage or size up to 30 tons, both gasoline or electric powered, and which have remarkable fuel economy, and a low center of gravity, are described in detail in the literature of Geo. D. Whitcomb Co., Rochelle, Ill.

THE ADVANTAGES OF THE SINGLE-OPENING TILTING MIXER

The 1927 Catalog of the Construction Machinery Co., 403 Vinton Ave., Waterloo, Iowa, in addition to completely describing the Wonder tilter in all sizes from 3½ to 40 cubic feet per minute, gives six reasons why the Wonder single-opening tilting mixer is the best buy.

THE LATEST SHOVEL, SCOOP AND SPADE CATALOG

CATALOG Catalog C, just issued by the Wood Shovel & Tool Co., Piqua, Ohio, describes the complete line of Wood shovels, scoops, spades and drainage tools.

HOISTS FOR SLACKLINE OPERATION

HOISTS FOR SLACKLINE OPERATION
The Flory slackline hoist, which meets the exacting
requirements of the slackline operator with either steam,
electric, gasoline or belt-driven types, is completely
described in Bulletin "ML" issued by the S. Flory
Mfg. Co., Bangor, Pa.
WHEELBARROW WITH A STRONGEE
FRONT TRAY BRACE
The Stating Wheelbarrow Co. Milyankee Wig.

THONT THAY BRACE
The Sterling Wheelbarrow Co., Milwaukee, Wis., which is always improving its standard line of wheelbarrows, describes in its latest literature the new front tray brace which gives greater strength and makes a better wheelbarrow for the same money.

ONE-MAN STEEL DUMP-TRAILERS

ONE-MAN STEEL DUMF-TRAILERS

Literature completely describing the Euclid one-man dump-trailer built of steel with wide wheels, capable of operating under extremely bad conditions behind a 2-, 5- or 1(-ton crawler tractor, is described in literature which may be secured from A. P. Armington, Euclid which may be secured from A. Crane & Hoist Co., Euclid. Ohio.
PORTABLE BELT-CONVEYORS

FORTABLE BELT-CONVEYORS

Belt-conveyors 12, 16 and 24 inches wide and any length up to 100 feet, mounted on trucks or furnished for suspension service, are described in the bulletins of the Northern Conveyor and Manufacturing Co., Janes-ville, Wis., which are builders of the well-known Northern Star cement bag cleaner and portable steel hoppers.

hoppers.
A NEW EXCAVATOR CATALOG

A NEW EXCAVATOR CATALOG
The Ineley Manufacturing Co., Indianapolis, Ind., in
its new catalog, No. 51, which contains 63 pages of
worth-while Illustrations and text, describes the Insley
excavator, which operates as a shovel, ditcher, skimmer
scoop, crane, dragline, snow-shovel, backfiller, magnet
and trailer. Insley will be pleased to send copies of
this catalog free on request to any contractor.

this catalog free on request to any contractor.

SURFACE TREATMENT WITH CUT BAOK ASPHALT
Cold surface treatment of asphaltic macadam roads
(penetration method) is completely described and illustrated in the latest literature of the Standard Oil Co.
of Indiana, 910 S. Michigan Ave., Chicago, III.
A NEW CATALOG ON STEEL MEASURING-BINS
AND LOADING HOPPERS
The Butter Bin Company Worksche Wile has ford

AND LOADING HOFFERS
The Butler Bin Company, Waukesha, Wis., has just issued a new 68-page catalog devoted to Butler steel loading-bins, measuring and weighing hoppers, bin gates, etc., which it will be glad to send to any contractors interested.

interested.

CONCEPTE PIPE MACHINERY

The McOracken Machinery Co., Sioux City, Iowa, has
recently issued a new catalog describing McCracken
concrete pipe machinery, illustrating the process, giving the details as to daily capacities and showing plans
in various parts of the United States and foreign coun-

GASOLINE LOCOMOTIVES FOR CONTRACTORS The Brookville gasoline locomotive made in suitable models for every contracting need from 1 ton weight up to 9 tons, is described in the general estalog of the Brookville Leesmotive Co., Breokville, Pa. CONCRETE BLOCK MACHINERY

The name "National" on concrete block machinery signifies all that is latest and best in block-making machinery and economy. A complete description of National block machines and power-tampers may be sourced from P. W. Witteman, Cement Block Machinery Co., 50-58 Columbia St., Newark, N. J.

STEEL PAVING GUARDS

Steel paring syndy which product the Advances.

Steel paving guards which protect the edges of all kinds of pavements at the weakest part are described and illustrated completely in the latest 63-page catalog of the W. S. Godwin Co., Inc., Race and McComas Sts., Baltimore, Md.

Baltimore, Md.
A SIMPLIFIED METHOD OF HARDENING
CONCRETE PLOORS

CONCRETE FLOORS
The Euclid Chemical Co., 7012-7016 Euclid Ave.,
Cleveland, Ohio, will be pleased to send its circular to
any contractor interested in an efficient floor hardener
which saves one-half to two-thirds of ordinary floorhardening costs. This saving is made possible through
the use of Euco crystals of magnesium floosilicate, which
are furnished in barrels, half barrels, and kegs.
RELIABLE POWER-PLANTS FOR INDUSTRIAL

MACHINERY MACHINERY
Contractors who agree that dependable, economical power is vital to the satisfactory operation of industrial machinery will be interested in the free literature of the Stover Mfg. & Engine Co., 15 Lake St. Freeport, Ill., which describes Stover quality engines with Wicomagneto for contractors' equipment.

STEEL SHEET-FILING
Washing Is a 149 Broadway New York will be

Memlinger, Inc., 149 Broadway, New York, will be based to correspond with any contractor wishing to at, sell, or buy steel sheet-piling or wishes to rent pleased

PLASTER AND MORTAR MIXERS

PIASTER AND MORTAE MIXERS

M.B mixers for plaster and mixing and make it possible better mix than with hand mixing and make it possible for plasterers to cover 15 to 20 per cent more yards per day, is completely described in the latest literature of the Meili-Blumberg Co. Inc., New Holstein, Wis. A FULL REVOLVING POWER-SHOVEL WITH TELESCOPE HOOM

The Star power-shovel, which operates as a crane, ditcher or backfiller and which has a powerful telescope boom capable of loading trucks 19 feet out or 17 feet up, and which is full revolving, operated either by gas or electricity, is completely described in the latest literature of the Star Drilling Machine Co., Akron, Ohio.

Ohio.

CABLEWAY SERVICE

Bulletin 56 issued by Street Brothers Machine Works, Inc., Chattanoogs, Tenn., describes Street cableways in detail and tells all about the Street cableway engineering department which you will find to be of great assistance on your job in showing you how to use overhead cableways to decrease costs.

assistance on your job in showing you how to use overhead cableways to decrease costs.

PORTABLE AIR-COMPRESSORS AND WELDERS
The 1927 catalog of Schramm, Inc., West Chester,
Pa., completely describes the full line of Schramm
portable air-compressors on iron wheels for truck
mounting, in compressor-tractor combinations, and
welders as well as stationary type compressors and
Schramm compressed-air tools.

STEEL FORMS FOR REINPORCED CONCRETE
COLUMNS
The Des Lauriers Metal Products Co., Inc., Detroit.

COLUMNS

The Des Lauriers Metal Products Co., Inc., Detroit, ich., will be pleased to send its latest literature secribing Des Lauriers steel molds for round concete columns to any contractors interested. These describing crete columns to any contractors interested. These forms are adjustable and adapted to all kinds of rein

forms are adjustable and adapted to all kinds of reinforced concrete construction.

A SYSTEM OF INSTALLING CONSTRUCTION
JOINTS IN CONCEPTE ROADS
Complete information regarding the Flex-Plane System of installing longitudinal and transverse joint construction in concrete roads will be found in the latest literature of the Flexible Road Joint Machine Co. Warren, Ohio. By this system cracks are combatted before they have an opportunity to appear.

AN AUTOMATIC HOIST FOR BUILDERS
The Zetterland average here whilding.

AN AUTOMATIC HOIST FOR BUILDERS

The Zetterlund automatic hoist which lowers building costs, saves time and energy and is economical and easy to erect, is completely described in the literature of the Zetterlund Hoist & Machine Co., 128-132 Ferry St., Milwaukee, Wis.

ASPHALT PRODUCTS FOR ROAD WORK

The Standard Oil Co. of New York, 26 Broadway, New York, will be pleased to furnish complete information to contractors interested in asphalt binders for surface treatment, for penetration work, for the mixing method, cold-patch asphalt for repairing all types of bituminous road surfaces, asphalt for sheet asphalt paving, joins fillers for brick or block pavements, and paving flux, bridge asphalt and preserving oils.





### TO more back-laming rope jerking!

No more arm-tiring, time-losing hand-hauling of dipper trip rope!

Now the Koehring takes still more hard work out of shovel operation—still further leaves the operator free to get high-speed action out of the shovel!

The Koehring dipper trips by power! Easy shifting hand-lever throws the clutch - and power does the rest!

Finger Tip ease of control for every function! That's one reason why the Koehring is fast!

That's why the operator can get quickas-a-cat action out of the Koehring

and hit a record-breaking pace to the last minute of the day's work!

Double outside band self-equalizing friction clutches - that's the reason for Finger Tip ease of control!

High bank work · · high or low dumping · · deep digging · · level, shallow stripping and grading — the Koehring is instantly ready for anything! Raise or lower boom without adjustments!

### Shovel Capacities

No. I - % cu. yd. dipper, struck measure, on 19 ft. 6 in. boom, with 16 ft. dipper sticks; 4 cylinder, 5% x 6/2 in. gasoline engine, 1000 R. P. M. No. 2-1% cu, yd. dipper, struck measure, on 20 ft. 7fn. boom, with 16 ft. dipper sticks; 4 cylinder 627 in. gas-

Go after Records!-and don't worry about taking anything out of the Koehring by doing so! Koehring Heavy Duty Con-struction means that the Koehring is built for record breakers!

Write for Shovel Bulletin No. 56

### KOEHRING COMPANY, WILWONSER PAVERS, MIXERS-GABOLINE SHOVELS, CRANES AND DRAGLINES



# "We ...every roadway...



GEORGE S. CHANEY, County Engineer of Washington County, with offices at Washington, Pa. Mr. Chaney has been in charge of city and county construction engineering for more than twenty years, and many of the finest concrete roads and bridges in Washington County were built under his supervision.

# give every bridge... this lasting protection"

"HEN I tell you that there are more than 450 bridges in this county," said George S. Chaney, County Engineer of Washington County, Pa., "and that every modern concrete bridge is adequately protected against expansion and contraction by means of expansion joints, you'll realize the importance we attach to its use.

"We use expansion joints in all our road work, too—in fact, this was

the first county in the state to build concrete roads with expansion joints.

"In our bridges, however, you do not actually see all the expansion joints. But they're there, just the same—protecting, though concealed, against temperature and moisture stresses in the concrete. Take this Wylie Avenue Arch: expansion joints are molded into the posts at the hand railings and on each side where the curb adjoins the road bed."

The splendid bridges and modern concrete roads throughout Washington County, Pa., are safeguarded indefinitely against cracking and deterioration by Carey

Elastite Expansion Joint. This material adds but a fraction to the cost of construction, but it effects a substantial saving in the cost of maintenance. Write for full details.

Carey Elastite Expansion Joint consists of a heavy body of fibrous asphaltic compound, sandwiched between two layers of asphalt-saturated felt. Will not flow in hot weather or become brittle in cold weather. As easily handled as a board.

### THE PHILIP CAREY COMPANY, Lockland, Cincinnati, Ohio

The Wylie Avenue Arch, Chartiers Creek, Washington County, Pa., constructed in 1926. It has a 60-foot span, 23-foot roadway, and two 6-foot sidewalks.





# Built to fit



\*Disc Wheels With Dual Rear, Optional Prices f. o. b. Detroit Construction works of the great empire builders of history are being dwarfed daily all about us. The modern contractor fashions into reality, with incredible swiftness, the dreams of architects and engineers—towering skyscrapers, splendid spans, broad highways, monster dams, gigantic factories.

Hundreds of millions of dollars are tied up in these projects. The contractor's profit is often governed by the dependability and operating cost of his equipment.

Contractors everywhere are

making money with Graham Brothers Trucks. Their low operating costs and the certainty of their performance make close bidding possible. Their power, ruggedness, speed and longlife make profit certain. Service is quickly available—always and everywhere.

Graham Brothers Trucks and Commercial Cars, complete with bodies, are made in sizes and styles to meet 91% of all hauling requirements. Mass production makes initial cost low. Graham Brothers build more trucks than any other exclusive truck manufacturer.

GRAHAM

SOLD BY DODGE BROTHERS DEALERS EVERYWHERE



# your business

Graham Brothers 2-Ton Truck has the Power, Speed and Stamina you need— Loads are Pay Loads—Costs are Low

Day after day more and more Graham Brothers Trucks are proving their exceptional value in the hauling of the various loads in the contractor's business.

They stand up. They have ample power. Operating and maintenance costs are low. Initial cost is surprisingly low because of Graham Brothers tremendous production.

The 2-Ton Truck is a favorite.

Many contractors are using it with disc wheels, dual in the rear. This is optional equipment. It affords greater traction in soft going.

Graham Brothers Trucks are sold complete with bodies to fit the needs of contractors. The all purpose dump body pictured below has enjoyed wide preference.

GRAHAM BROTHERS

A DIVISION OF DODGE BROTHERS, INC.



# BROTHERS \_TRUCKS \_

### EASTON FORTY TRAILER \$250 F.O.B. EASTON



Capacity 11/2 Yards 40 cu. feet

### **OUARRY OPERATORS AND CONTRACTORS HAVE SAID**

"There is no question in our mind about the usefulness of the trailer itself; it is well built, and we think should last almost indefinitely."

"Each trailer is equivalent to about four to five two-horse teams with dump wagons."

"We find it easier now-adays to obtain good tractor drivers than to secure the right kind of team drivers."

"The trailers are well made and require few repairs."

"We find it easier now-a-days to obtain good tractor drivers than to sufficient to take care of it."

## EASTON CAR & CONSTRUCTION CO. EASTON PENNA.

# Standard Hoists and Der For the General Contractor EAM · ELECTRIC · GASOLINE

The Gettins-Kopitke Co., general contractors, of Toledo, Ohio, erected the building shown below in eighty-one days, counting Sundays and holidays.

This includes erection of the steel frame, laying the cut stone walls; plastering and decorating.

All materials were handled with Clyde

two-drum gasoline hoists.

The Company writes as follows:

"Our gasoline hoists have been in more or less continuous service since they were purchased in July, 1924, and have been very satisfactory in every respect. They are especially the same of a limited and service since they were purchased in July, 1747, and have been very satisfactory in every respect. They are especially convenient in the business district when space is limited and where the smoke nuisance is prohibitive. Because of their easy portability and low cost of operation; we are using them on most of our jobs.

"Although you have never asked us for this information, we feel you will welcome another satisfied customer." You'll Take Pride in Your Clyde!

### CLYDE IRON WORKS SALES COMPANY

Sole Distributors for CLYDE IRON WORKS, Duluth, U.S.A.

NEW ORLEANS 309 Magazine St

Stocks Carried in the Following Warehouses: NEW YORK CITY E. 136 St. and Locust Ave.

PORTLAND, ORE. 555 Thurman St.

SEATTLE 3410 First Ave. Se

CHICAGO CINCINNATI
II So. La Salle St. 1913 Union Cent. Bldg.

Branch Offices: MEMPHIS 69 Union Ave.

JACKSONVILLE 43-45 W. Foreyth St.

SAN FRANCISCO

### **MEAD-MORRISON**

### What you Get OUT of a Hoist Depends on What the Maker puts INTO it



More Evidence of Handi-Hoist Performance, 98 Tons in 61/2 Hours

42 Minutes to unload and store the contents of a 55-ton car of gravel. 614
Mass-double to load and deliver 98 tons of gravel with a single 314-ton truck. That's how
2 Mead-Morrison Handl-Hoista are cutting costs at this skip-car plant. Contractors are using Handl-Hoists for a wide range of work—scraper bucket, elevator,
derrick, pile-driver, mast hoist plant, etc.

Mead-Morrison Hoists are designed and built to give maximum service. Each machine represents years of hoist-making experience. Use of the best materials by Mead-Morrison engineers gives strength, dependability and long life.

You will find the Handi-Hoist a fast, powerful machine. Compact and light, it can be easily loaded on a truck and moved from job to job. Write for Catalog.

MEAD-MORRISON MFG. CO. 348 Prescott St., Boston, Mass. Canadian Factory: Welland, Ont.

Branch Offices:
New York Montreal Chicago
Distributors in Principal Cities

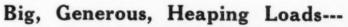
HOISTING - HAULING - HANDLING



### THE HARDSOCG WONDER DRILL

Will save you time on any rock-drilling job—no matter how difficult. You will find it a small air-consumer, easy to handle, smooth-running and trouble-free. It has seven less parts than other drills have, therefore the wear and upkeep expense is much less. It's a "Wonder." Let us tell you more about it.

HARDSOCG WONDER DRILL CO. OTTUMWA, IOWA





Here goes 5 yards of dirt - loaded in less than a minute!

Automatic dirt moving, the "Baker Maney way," gives you the yardage you want with a handful of men. It takes but ten seconds to load one scraper. A four-scraper train of Model D Baker Maney Scrapers, holding five yards of dirt, can be loaded in less than a minute.

Your grading job is simplified. Only one scraper man is used for three scrapers and only two on larger trains. Think of handling 500 to 600 yards of dirt with these few men!

These big powerful scrapers are built strong enough to be loaded to the cross-bars by the heaviest tractors built—usually digging directly into the unplowed ground. That's a real test for strength.

For details write us or tear out the coupon.

The Baker Manufacturing Co. 585 Stanford Ave., Springfield, Ill.



"The Original Self-Loading Scrapers"

For short hauls and small jobs, ask about the New Baker One-Man Automatic Rotary Scrapers built in four sizes for any Tractor.

### -and for backfilling

use a

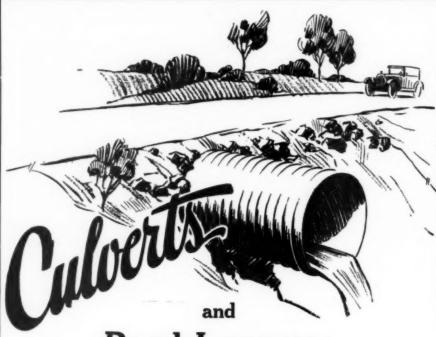
### Baker One-Man Backfiller

for use with leading light industrial tractors.

Does the work of 10 to 15 men on backfilling trenches, pushing dirt over banks, etc. A useful tool for every contractor on any job.

### Tear out and mail this coupon

The Baker Mfg. Co. 585 Stanford Ave. Springfield, Ill.	Baker Maney Scrapers  Rotary Scrapers
Send literature on items checked	☐ Backfillers
NAME	
ADDRESS	
***************************************	
(	)



### Road Insurance

After the cold spell, when the earth begins to thaw—a slow, but nevertheless apparent, shifting of the ground under the roadbed takes place. Ordinary, rigid clay or cement culverts break under the strain, flooding the road and shutting off the flow of traffic.

An installation of NEWPORT GENUINE OPEN HEARTH IRON CULVERT solves the problem. They will not crack or break.

### "CORRUGATED FOR STRENGTH GALVANIZED FOR LONG-LIFE"

No more expensive renewals or repairs. NEWPORT GOHI CULVERTS are guaranteed to be

### 99.875% PURE IRON-COPPER ALLOY

Made in all sizes, in multiples of two feet . . . easily installed by unskilled workmen. Let our Engineering Department advise you. This service is gratis. No obligation.



Write at once for free Corrugated Culvert Handbook "C."
It is very valuable.



### Would You Walk or Run Down a Strange, Dark Alley?

NOT much question as to what you'd do. You would walk-instinct of caution, of course.

It's that instinct of caution that slows up the shovel operator when he can't see his truck.

The operator's position in the cab of a Link-Belt Shovel is so far forward— "there are no blind-spots"—you don't have to pay the price of man's inherent instinct of caution concerning that which he cannot see—

But then—that's just one of the reasons why it's profitable to own a Link-Belt Shovel. The big reason is—

It's always on the job.

Only 19 gears in the whole machine and four friction clutches powerful and fast enough to perform any kind of work. Repairs therefore, are few and far between—but when they must be made—accessibility insures a minimum of time lost.

"Crawler Facts" has been written for the man who wants the answer to "Why Link-Belt Shovels are breaking speed records and making larger profits for their owners?"

Our nearest office will be glad to send them to you. Write today.

Some territories still open for Agents. Get our proposition.

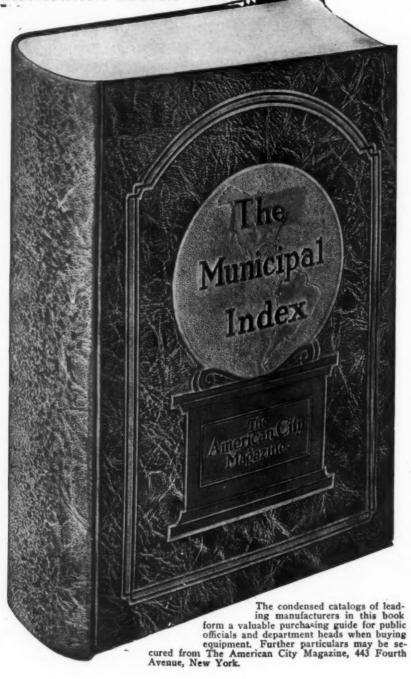
LINK-BELT COMPANY

2959-C

Leading manufacturers of Elevating, Conveying, and Power Transmission Machinery
CHICAGO, 300 W. Pershing Road
Offices in Principal Cit

## LINK-BELT SHOVEL

1927 Edition ready for distribution March 15th



## Surface Treatment Using CUT BACK ASPHALT for Cold Surface Treatment

An outline of the process shown by photographs taken on the Rockford Township Road, back of Sinissippi Park, Rockford, Illinois



The road before treatment. Asphalt Macadam (Penetration Method). Note the bad slump caused by sewer ditch. Road in rough condition due to settling of base.

Showing first application of Cut Back Asphalt for Surface Treatment. Application of 3/10 gallons per square yard after surface was broomed.

An application of clean, washed gravel, graded from 1¼" to 0½", was then spread. 22 lbs. of gravel per square yard was used. Photo shows gravel in place.



Second application of Cut Back Asphalt for Surface Treatment. This application was made at the rate of 2/10 gallon per square



Resurfacing being developed by dragging with road maintainer. Gravel is thoroughly mixed with asphalt and road surface is brought to grade.



Treatment completed. Depressions filled. Gravel completely mixed with asphalt. An application of pea gravel may be made, or a seal coat put on.

### STANDARD OIL COMPANY

General Offices: 910 S. Michigan Ave.,

CHICAGO, ILLINOIS



5-7 TONS 10-12 TONS

### CLOSE WORK

When conditions demand a roller capable of getting about in close quarters, look to Huber. Clear vision and perfect control enable the operator of a Huber 4-Cylinder Roller to run up to the very edge of an unfinished pavement or curb with perfect case. Dependable as steam, easy to handle, four sizes (5-7-10-12 tons) from which to choose. Send for free, fully illustrated book.

THE HUBER MFG. CO. 308 Center St., MARION, OHIO

# What a TRAYLOR Compressor will do—

- 1. Will run five (5) pneumatic drills.
- WRITE FOR NEW REDUCED PRICES NOW AN EFFECT
- 2. Will run fourteen (14) chipping hammers and keep the gang busy.
- 3. The 40% overload capacity of the motor meets the extra demand.

WRITE FOR NEW REDUCED PRICES NOW IN EFFECT

Their full-ball-bearing-throughout; their efficient water pump; and their large receiver capacity make these double-acting, slow speed compressors unbeatable.

For Rock Drilling and "Cement-Gun" Work

Write for full information.

CEMENT-GUN COMPANY, INC., Allentown, Pa. New York, Pittsburgh, Chicago, Salt Lake City, San Francisco, Seattle, Jacksonville, Fla.

### Dependable Power



for Every Purpose

## STAMINA FOR DAILY OPERATION

Seven, eight, nine hours a day, and far into the night, comes the incessant need for dependable power.

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Wherever industry functions and gasoline power is employed, Red Seal Continental Motors are doing full duty in furnishing dependable, economical power. And behind each Continental Motor are 26 years of motor building experience and quality workmanship—a combination which assures the user the utmost satisfaction in his power plant.

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Let the powerful steel arm of a Speeder Crane do your lifting. It does the work of twenty men, at far less cost. It never tires, never kills time or loafs on the job. Traveling on its own crawlers, with two speeds, the machine is readily steered into any position, and swings its load to any point in a full circle.

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On the "in-between" job—too small for the heavy steam shovel and too large for hand-digging to be economical—the WILFORD POWER SHOVEL powered by the Fordson tractor means bigger profits—more vards per dollar.

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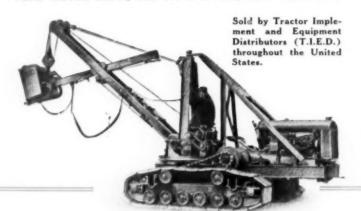
Look for it at the Ford Power Equipment Exposition.

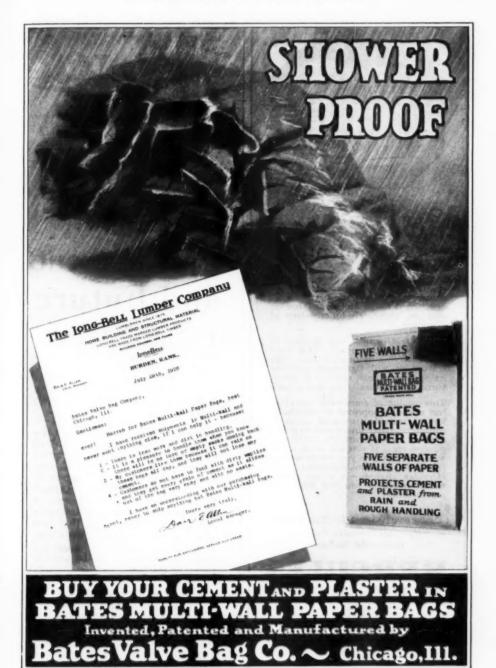
There are over 200 exhibits, in all, of industrial and agricultural equipment for the Fordson Tractor and Ford chassis, to be seen at any time at the Exposition building. Come and look them over, or write us what types of apparatus interests you, and we will send you particulars.



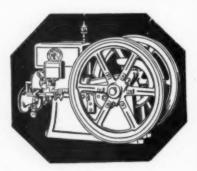
# POWER EQUIPMENT EXPOSITION

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# HERCULES





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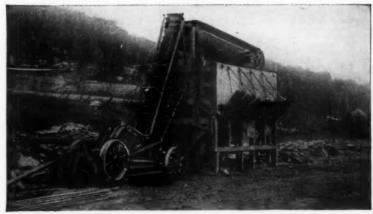
EVEN though the most visionary mind is incapable of accurately picturing the position the motor truck will eventually hold in the field of transportation, yet it is possible to definitely judge the future of the vehicles themselves by their past records.

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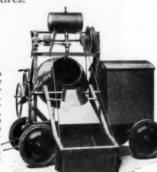
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UNION equipment for construction work also includes Grout Mixers and Ejectors, Cableway Skips, Tunnel Shields, Air Locks, etc. (All described in Bulletin 63.)

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friends—because of its many uses—because it stands up and does its work under all conditions—and be-cause it SAVES REAL MONEY.

This unit mounted on a Fordson has made many

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On any contract where you can use one or two scrapers this machine will pay for itself.

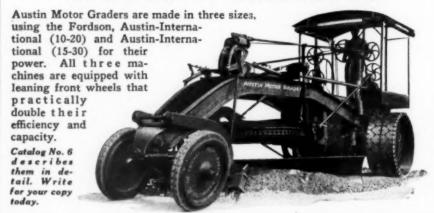
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In figuring costs, many contractors fail to take account of the high cost of delivering the air from the compressor to the tools. Leaks and line losses are expensive, not to mention the extra cost of an attendant to watch the compressor as the operators work away from

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Designed by a company with 73 years manufacturing experience, 30 of which have been devoted to pneumatic engineering and high-grade compressor manufacturing, the Curtis unit has been found by contractors to be capable of taking the place of all other types. can successfully standardize on this one unit.

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Through a period of years, the Curtis Portable outfit has become more and more popular. It is now in demand in all communities or a demand can easily be built by stocking and showing a sample unit.

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all the work. The driver needs only operate a convenient clutch lever. In addition to operating the scraper the powerful winch has been adapted to a backfiller extension that in being very successfully used in filling trenches, building berm and cleaning ditches.

# The Miami, one-man operated, power Scraper is the most versatile Tractor Scraper made, due in large measure to the fact that the lead in carried on wheels to the dump, allowing ease of movement in all positions and especially in backing with full load. The Powerful Miami Winch together with the tractors power doss

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All Stool Bottom Dump or Sectional Stake Platform Body; Timken Roller Bearings; Alemite Wheel Lubrication; 21/2 Tone Capacity; Turns In Its Own Length Used With Any Type Tractor. Dump Trailer Has 60 x 38 Inch Bottom Opening.

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Capacity 75 to 160 tons per hour. All lengths up to 100-ft. — 24-in. belt width. Gas Engine or Electric Motor Power.



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Belt Scraper and Stationary Conveyors, Portable Steel Hoppers, Bag Cleaners



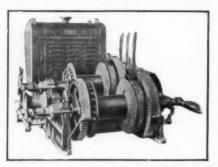






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# FLORY

GASOLINE HOIST

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CAPACITY 5,500 POUNDS AT 175 FT. PER M:N. 50 H.P. 2,400 POUNDS AT 400 FT. PER MIN.

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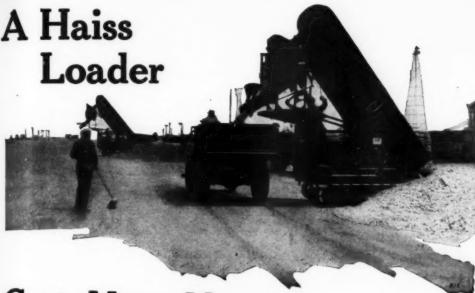
will properly heat and apply the heaviest asphalts and tars as well as the lighter grades of bituminous road material with equal efficiency and with the least expenditure of time, labor and money.

Equipped with the Kinney Positive Pressure Pump and the Kinney Spraying Nozzles and circulating and heating systems. Self-loading from tank cars.

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Milwaukee, Mfrs. Steel Dump Bodies, Hoists and Tanks for Motor Trucks.



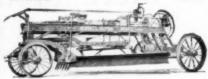
# Road Equipment

Road Road Road Building Maintenance Repairing



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Made in 3 sizes Russell Motor Patrol No. 4 has the Caterpillar Russell Motor Patrol No. 4 has the Caterpillar 2-Ton Tractor for power.
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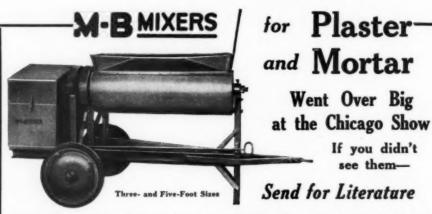


Complete specifications for all concrete curing, both surface and integral methods, are in the new Solvay booklet—it's free on request—send the coupon NOW!

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The Blades are superior in their action to others—give a better and more thorough mix. Clutch Control and Tilting Lever at Same End of machine where they ought to be. Engine Highest Grade—Alemite Lubrication of Gears—All well protected.

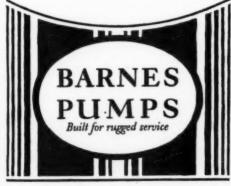


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#### ONLY MIXER THAT SHOVELS

Makes a mix superior to any other on the market

Uses 30-40% more sand than when plaster is mixed by hand. Mixes plaster for 25 plasterers

Will go through a door 30 inches wide

Plenty of power, built-in clutch die-cast bearings, alemite lubrication, steel or hard-rubber-tired wheels with roller bearings underslung spring axle

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Work guaranteed

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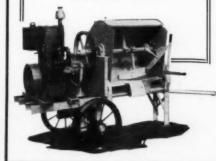
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Every description of fabricated steel.

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Dust-proof Counter Drive Shaft Bearing—Drum
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Wheels—Positive Gear Drive.

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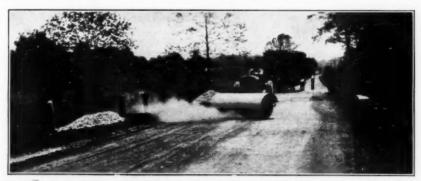
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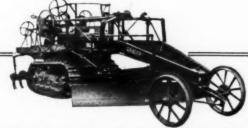
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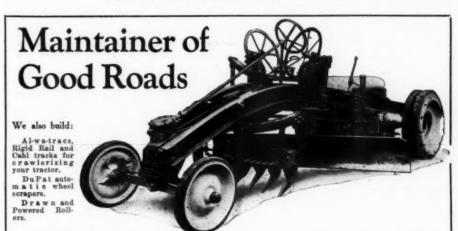
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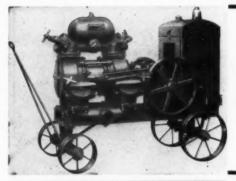


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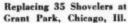
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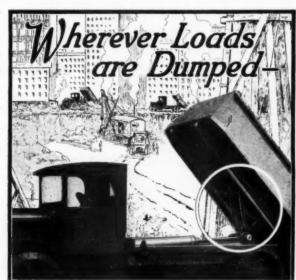
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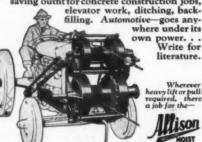
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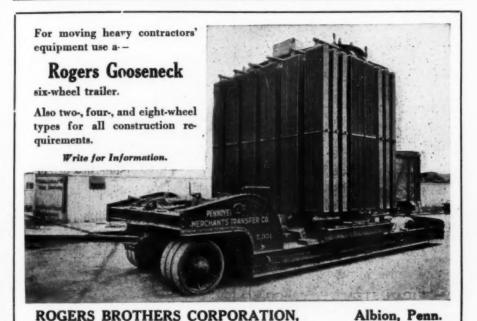
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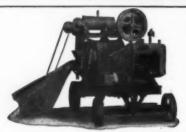
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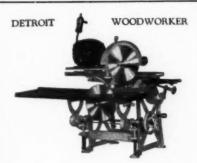
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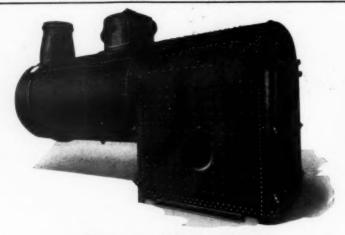
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Run your eye over pages 3 to 44



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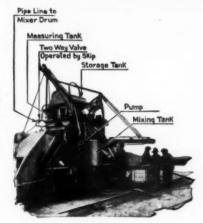
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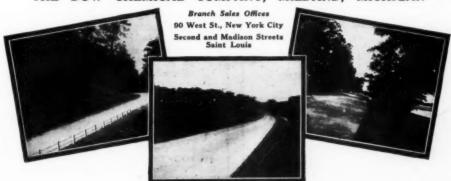
Dowflake Admixture Curing has revolutionized old-time methods of curing concrete. Added right in the mix, in the form of a solution, it does away with all the expense and trouble of earth-covering, eliminates the need of anywhere from three to six extra men, and results in a faster-setting, more uniformly cured slab.

It also makes the concrete more plastic—easier to spread and finish. It reduces the tendency toward surface cleavage, voids and pitting.

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We will be glad to send complete information to those interested in this improved method of concrete curing. Write for copy of free booklet, "How to Cure Concrete."

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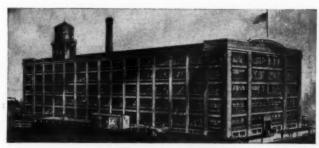
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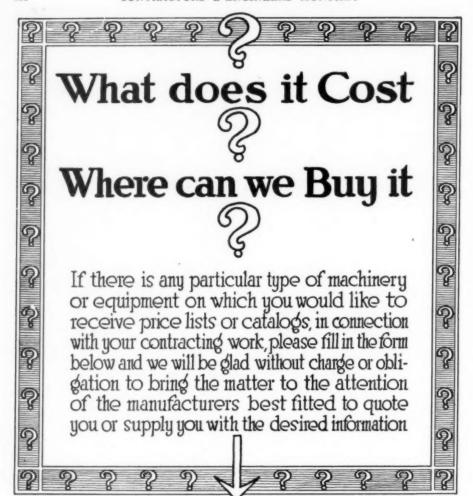
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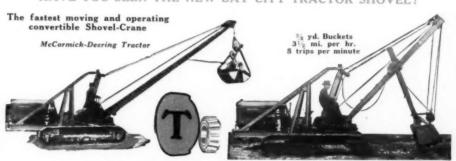
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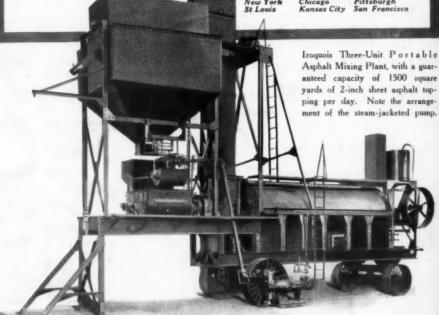
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